Plant Physiol. (1987) 85, xxii–xxiv
0032-0889/87/85/xxii/03/$01.00/0

Author Index

A

Adams, Douglas O., 463
Adhikari, Jukta, 611
af Ugglas, Magnus, 860, 865
Albert, Frederick, 537
Alexandre, Joël, 608
Allen, Anthony K., 566
Allnutt, F. C. Thomas, 746, 751
Anderson, Anne J., 537
Anderson, Joan C., 66
Anderson, Louise E., 598
Anderson, Michael P., 283
Araus, José L., 667
Ashworth, Dennis J., 463
Avila, Concepción, 1036
Ayers, Arthur R., 508

B

Balague, Claudine, 400
Baleriola-Lucas, Cristina, 419
Barber, James, 194
Barta, Terese M., 335
Barton, Kenneth A., 1103
Basso, Barbara, 674
Beaudry, Randolph M., 277
Beevers, Harry, 1084
Beevers, Leonard, 1118
Ben-Hayyim, Gozal, 430, 434
Bennett, Alan B., 502
Bennetzen, Jeffrey L., 327
Benveniste, P., 51
Bergami, Mario, 631
Berkowitz, Gerald A., 655, 1040
Bestman, Hank D., 82
Bethlenfalvay, Gabor J., 115, 120
Bewley, J. Derek, 575
Bhaduri, Tirtha Jyoti, 611
Białczyk, Jan, 581
Bienfait, H. Frits, 310
Bittisnich, Dennis J., 554
Black, Clanton C., 277
Blanchar, Robert W., 315
Bleecker, Anthony B., 87
Blevins, Dale G., 315
Bloom, Mark, 182
Blumwald, Eduardo, 30
Bogorad, Lawrence, 757, 808, 816
Bonham-Smith, Peta C., 575
Bonner, Bruce A., 212
Bonner, Walter D., Jr., 746, 751
Borochov, Amihud, 1068
Boschek, Bruce, 124
Bose, Salil, 17
Boss, Wendy F., 389
Botella, José R., 1036
Bouvier-Navé, Pierrette, 51
Bowman, William D., 1055
Boyer, John S., 261
Boyle, F. A., 621
Bozarth, Connie S., 261
Bracker, Charles A., 529
Breidenbach, R. William, 1048
Bressan, Ray A., 174, 529
Brightman, Andrew O., 1151
Briskin, Donald P., 1129, 1137
Brown, Gregory G., 304
Brown, J. H., 679
Brown, Milford S., 115, 120
Brown, Patrick H., 801
Buchanan, Bob B., 13, 446
Buckel, Scott, 529
Bukovac, Martin J., 965
Burke, John J., 100
Burkey, Kent O., 971
Burnell, James N., 952
Bush, Daniel R., 845
Bush, Douglas Scott, 247
Butcher, Dennis N., 996
Buttery, B. R., 20
Buzzell, R. I., 20
Bzonek, P., 375

C

Cakmak, Ismail, 310
Cánovas, Francisco M., 1036
Carboner, Daniela, 299
Cary, Earle E., 801
Ceppi, Davide, 720
Cervone, Felice, 626, 631
Chappell, Joseph, 469
Chapple, Clint C. S., 78
Cheng, Shu-Hua, 978
Cherry, Joe H., 4
Chien, Lee Feng, 158
Chou, Qun, 13
Chrispeels, Maarten J., 741
Chui, Chok-Fun, 1110
Clark, Robert A., 984
Cleland, Robert E., 693
Cline, Morris G., 104
Clithero, Jean M., 174
Coleman, John R., 26
Colombo, Roberta, 383
Cornwell, Karen L., 780
Costes, Claude, 1026
Coutts, John H., 290
Crafts-Brandner, Steven J., 662
Cragoe, Edward J., Jr., 30
Crawford, Robert M. M., 1016
Creelman, Robert A., 726
Crétin, Claude, 34, 243
Croteau, Rodney, 1123
Cutler, Adrian J., 1099

D

Dacey, John W. H., 199
Daie, Jaleh, 711
Daley, Larry S., 1089
DasGupta, Sarmila, 611
deBoer, Albertus H., 693
Debus, Richard J., 1021
Degrà, Luisa, 626, 631
DellaPenna, Dean, 502
Delmer, Deborah P., 1008
DeLorenzo, Giulia, 626, 631
Del Río, Luis A., 570
De Luca, Vincenzo, 1099
DeMaggio, Augustus E., 343
Demmig, Barbara, 1000
DePass, Anthony, 850
Devine, Malcolm D., 82
De Vries, Hilde M., 331
Dhindsa, Rajinder S., 1094
Dickinson, David B., 841
Dietz, Karl-Josef, 808, 816
Donaldson, Robert P., 792, 796
Dumas, Christian, 876
Dumbroff, Erwin B., 78
Dupuis, Isabelle, 876
Dybing, C. Dean, 91

E

Earnshaw, Brent A., 273
Edwards, Gerald E., 294
Egli, Dennis B., 662
Elbein, Alan D., 741
Elder, Peter A., 46
Ellis, Brian E., 78
Ellis, Richard J., 689
Elzenga, J. Theo M., 239
Ensminger, Peter A., 879, 885
Entwisle, Lynda O., 554

F

Fagerstedt, Kurt V., 1016
Fang, Tung K., 792
Farmer, Edward E., 733
Fenoll, Carmen, 327
Fernandez, Donna E., 487
Ferron, Françoise, 1026
Feyerabend, Martin, 835
Finnegan, Patrick M., 304
Fisk, Henry J., 1123
Flugge, I. U., 621
Fobel, Maribeth, 204
Fox, Theodore C., 474
Franceschi, Vincent R., 978
Frenkel, Chaim, 56
Fritzemeier, Karl-Heinrich, 34
Furbank, Robert T., 958
Furuya, Masaki, 1146

G

Gadal, Pierre, 243
Gage, Douglas A., 726
Galston, Arthur W., 542
Ganmore-Neumann, Ruth, 434
García-Martínez, José L., 212
Gates, David M., 109
Geiger, Donald R., 365, 370
Gentinetta, Eugenio, 720
Ghiasi, H., 91
Giannini, John L., 1129, 1137
Gildensoph, Lynne H., 1129
Gilmour, Sarah J., 87
Girard, Vincent, 131
Goldberg, Israel, 716
Goldsbrough, Peter B., 1031
Gómez, Manuel, 570
Gonzalez, Mercedes Garcia, 585
Goodfellow, V. J., 375
Goudey, J. Stephen, 155
Gounaris, Kleoniki, 194
Gressel, Jonathan, 869
Grimes, Howard D., 1048
Grölz-Krug, Sabine, 124
Gross, Kenneth C., 804
Guerrini, Franca, 828
Guo, Wei Wen, 1089
Guralnick, Lonnie J., 481
Gurevitz, Michael, 1021
Gurkewitz, Sandra, 1123

Plant Physiol. (1987) 85, xxii–xxiv
0032-0889/87/85/xxii/03/$01.00/0

Author Index

A

Adams, Douglas O., 463
Adhikari, Jukta, 611
af Ugglas, Magnus, 860, 865
Albert, Frederick, 537
Alexandre, Joël, 608
Allen, Anthony K., 566
Allnutt, F. C. Thomas, 746, 751
Anderson, Anne J., 537
Anderson, Joan C., 66
Anderson, Louise E., 598
Anderson, Michael P., 283
Araus, José L., 667
Ashworth, Dennis J., 463
Avila, Concepción, 1036
Ayers, Arthur R., 508

B

Balague, Claudine, 400
Baleriola-Lucas, Cristina, 419
Barber, James, 194
Barta, Terese M., 335
Barton, Kenneth A., 1103
Basso, Barbara, 674
Beaudry, Randolph M., 277
Beevers, Harry, 1084
Beevers, Leonard, 1118
Ben-Hayyim, Gozal, 430, 434
Bennett, Alan B., 502
Bennetzen, Jeffrey L., 327
Benveniste, P., 51
Bergami, Mario, 631
Berkowitz, Gerald A., 655, 1040
Bestman, Hank D., 82
Bethlenfalvay, Gabor J., 115, 120
Bewley, J. Derek, 575
Bhaduri, Tirtha Jyoti, 611
Białczyk, Jan, 581
Bienfait, H. Frits, 310
Bittisnich, Dennis J., 554
Black, Clanton C., 277
Blanchar, Robert W., 315
Bleecker, Anthony B., 87
Blevins, Dale G., 315
Bloom, Mark, 182
Blumwald, Eduardo, 30
Bogorad, Lawrence, 757, 808, 816
Bonham-Smith, Peta C., 575
Bonner, Bruce A., 212
Bonner, Walter D., Jr., 746, 751
Borochov, Amihud, 1068
Boschek, Bruce, 124
Bose, Salil, 17
Boss, Wendy F., 389
Botella, José R., 1036
Bouvier-Navé, Pierrette, 51
Bowman, William D., 1055
Boyer, John S., 261
Boyle, F. A., 621
Bozarth, Connie S., 261
Bracker, Charles A., 529
Breidenbach, R. William, 1048
Bressan, Ray A., 174, 529
Brightman, Andrew O., 1151
Briskin, Donald P., 1129, 1137
Brown, Gregory G., 304
Brown, J. H., 679
Brown, Milford S., 115, 120
Brown, Patrick H., 801
Buchanan, Bob B., 13, 446
Buckel, Scott, 529
Bukovac, Martin J., 965
Burke, John J., 100
Burkey, Kent O., 971
Burnell, James N., 952
Bush, Daniel R., 845
Bush, Douglas Scott, 247
Butcher, Dennis N., 996
Buttery, B. R., 20
Buzzell, R. I., 20
Bzonek, P., 375

C

Cakmak, Ismail, 310
Cánovas, Francisco M., 1036
Carboner, Daniela, 299
Cary, Earle E., 801
Ceppi, Davide, 720
Cervone, Felice, 626, 631
Chappell, Joseph, 469
Chapple, Clint C. S., 78
Cheng, Shu-Hua, 978
Cherry, Joe H., 4
Chien, Lee Feng, 158
Chou, Qun, 13
Chrispeels, Maarten J., 741
Chui, Chok-Fun, 1110
Clark, Robert A., 984
Cleland, Robert E., 693
Cline, Morris G., 104
Clithero, Jean M., 174
Coleman, John R., 26
Colombo, Roberta, 383
Cornwell, Karen L., 780
Costes, Claude, 1026
Coutts, John H., 290
Crafts-Brandner, Steven J., 662
Cragoe, Edward J., Jr., 30
Crawford, Robert M. M., 1016
Creelman, Robert A., 726
Crétin, Claude, 34, 243
Croteau, Rodney, 1123
Cutler, Adrian J., 1099

D

Dacey, John W. H., 199
Daie, Jaleh, 711
Daley, Larry S., 1089
DasGupta, Sarmila, 611
deBoer, Albertus H., 693
Debus, Richard J., 1021
Degrà, Luisa, 626, 631
DellaPenna, Dean, 502
Delmer, Deborah P., 1008
DeLorenzo, Giulia, 626, 631
Del Río, Luis A., 570
De Luca, Vincenzo, 1099
DeMaggio, Augustus E., 343
Demmig, Barbara, 1000
DePass, Anthony, 850
Devine, Malcolm D., 82
De Vries, Hilde M., 331
Dhindsa, Rajinder S., 1094
Dickinson, David B., 841
Dietz, Karl-Josef, 808, 816
Donaldson, Robert P., 792, 796
Dumas, Christian, 876
Dumbroff, Erwin B., 78
Dupuis, Isabelle, 876
Dybing, C. Dean, 91

E

Earnshaw, Brent A., 273
Edwards, Gerald E., 294
Egli, Dennis B., 662
Elbein, Alan D., 741
Elder, Peter A., 46
Ellis, Brian E., 78
Ellis, Richard J., 689
Elzenga, J. Theo M., 239
Ensminger, Peter A., 879, 885
Entwisle, Lynda O., 554

F

Fagerstedt, Kurt V., 1016
Fang, Tung K., 792
Farmer, Edward E., 733
Fenoll, Carmen, 327
Fernandez, Donna E., 487
Ferron, Françoise, 1026
Feyerabend, Martin, 835
Finnegan, Patrick M., 304
Fisk, Henry J., 1123
Flugge, I. U., 621
Fobel, Maribeth, 204
Fox, Theodore C., 474
Franceschi, Vincent R., 978
Frenkel, Chaim, 56
Fritzemeier, Karl-Heinrich, 34
Furbank, Robert T., 958
Furuya, Masaki, 1146

G

Gadal, Pierre, 243
Gage, Douglas A., 726
Galston, Arthur W., 542
Ganmore-Neumann, Ruth, 434
García-Martínez, José L., 212
Gates, David M., 109
Geiger, Donald R., 365, 370
Gentinetta, Eugenio, 720
Ghiasi, H., 91
Giannini, John L., 1129, 1137
Gildensoph, Lynne H., 1129
Gilmour, Sarah J., 87
Girard, Vincent, 131
Goldberg, Israel, 716
Goldsbrough, Peter B., 1031
Gómez, Manuel, 570
Gonzalez, Mercedes Garcia, 585
Goodfellow, V. J., 375
Goudey, J. Stephen, 155
Gounaris, Kleoniki, 194
Gressel, Jonathan, 869
Grimes, Howard D., 1048
Grölz-Krug, Sabine, 124
Gross, Kenneth C., 804
Guerrini, Franca, 828
Guo, Wei Wen, 1089
Guralnick, Lonnie J., 481
Gurevitz, Michael, 1021
Gurkewitz, Sandra, 1123

H

Hahlbrock, Klaus, 34
Hamdi, Said, 393
Handa, Aytar K., 529
Hara-Nishimura, Ikuko, 440
Harley, Suzanne M., 1118
Hartmann, Elmar, 1151
Hartnett, Mary E., 898
Hasegawa, Koji, 379
Hasegawa, Paul M., 174, 529
Hashimoto, Takashi, 145
Hashimoto, Tohru, 379
Hassidim, Miriam, 872
Hata, Shingo, 947
Hatch, Evelyn, 1031
Hatch, Marshall D., 952, 958
Hatfield, Jerry L., 100
Heber, Ulrich, 922, 928
Heichel, Gary H., 283
Heldt, Hans W., 621
Helgeson, John P., 733
Hendrix, Donald L., 588
Hermodson, Mark A., 529
Hetherington, P. Richard, 1068
Heuss-La Rosa, Kathleen, 4
Hills, Matthew J., 1084
Hirano, Hisashi, 942
Hitz, William D., 407, 902
Hodson, Robert C., 898
Holmgren, Arne, 446
Hopkins, William G., 648
Hoshiai, Sawa, 906
Howell, Dawn A., 322
Howley, Kathleen S., 22
Hsu, Ban Dar, 158
Hu, Chunfang, 299
Huang, Bin, 1031
Hurley, Ursula A., 268

I

Ikeuchi, Masahiko, 638
Ikuma, Hiroshi, 879, 885
Ingemarsson, Björn, 856, 860, 865
Inoue, Yorinao, 638

J

Jansson, Christer, 1021
Jellison, Jody, 508
Jenkins, Colin L. D., 952
Jiao, Xin-Zhi, 643
Jochimsen, Bjarne U., 452
Johnson, Kenneth D., 741
Johnson, Mark A., 1123
Johnson, Morris A., 273
Johnson, Thomas C., 446
Johnson-Flanagan, Anne M., 699
Jollie, David R., 457

K

Kafkafi, Uzi, 434
Kagawa, Hiroyuki, 942
Kamiya, Akiyoshi, 906
Kamoshita, Katsuzo, 1146
Kano-Murakami, Yuriko, 942
Kapoor, Manju, 575
Kasperbauer, Michael J., 350
Kates, David S., 502
Kato, Akemi, 906
Kays, Stanley J., 277
Keegstra, Kenneth, 780
Keith, Brian, 212, 934
Kennedy, Robert A., 474
Keryer, Eliane, 243
Khurana, J. P., 10
Kieliszewski, Marcia, 823
Kim, Jongkee, 804
Klein, Uwe, 892
Klepper, Lowell A., 96
Klessig, Daniel F., 167
Knievel, Daniel P., 558
Knowles, Vicki, 182
Kobayashi, Hirokazu, 757
Kombrink, Erich, 34
Ku, Maurice S. B., 978, 1063
Kumpaisal, Rosarin, 145
Kurosaki, Fumiya, 601

L

Lamport, Derek T. A., 823
Landry, Jacques, 1026
Lange, Otto L., 109
Lange, Otto-Ludwig, 922, 928
Langston-Unkefer, Pat J., 845
Laroche, André, 648
LaRosa, P. Christopher, 174
Larsen, Knud, 452
Larsson, Carl-Magnus, 860, 865
Lassalles, Jean-Paul, 608
Layzell, David B., 137
Lechowski, Zbigniew, 581
Lee, Lisa, 327
Lee, Rino Y., 463
Legris-Delaporte, Stéphanie, 1026
Lelievre, Jean-Marc, 400
Leopold, A. Carl, 224, 232
Lerner, Henri R., 383, 872
Levitt, Linda K., 318
Li, Yi, 910
Lipton, Doug S., 315
Lomax, Terri L., 693
Lopez, Francis B., 990
Lord, J. Michael, 1
Louis, Jean-Paul, 393
Lucas, William J., 423
Luster, Douglas G., 796
Lynch, Daniel V., 204
Lynch, D. V., 679

M

Macdonald, Fraser D., 13
Maclachlan, Gordon, 131
Maeso, Eva Sanchez, 585
Maheshwari, N., 10
Maheshwari, S. C., 10
Majumder, Arun Lahiri, 611
Majumder, Asima Lahiri, 611
Mannan, Ramasamy Mannar, 17
Marschner, Horst, 310
Martinoia, Enrico, 922, 928
Mathis, James N., 971
Matsuoka, Makoto, 942, 947
Matthys-Rochon, Elisabeth, 876
Mayer, Randall R., 4
Mayoral, Maria Luisa, 786
Mazelis, Mendel, 1079
Mazur, Barbara J., 1110
McColl, John G., 247
McCurdy, David W., 268
McDavid, Charles R., 990
McIntosh, Lee, 1021
McKersie, Bryan D., 1068
McWha, James A., 46
Meyer, Yves, 400
Migliaccio, Fernando, 542
Mihara, Keiko L., 115
Miles, C. Donald, 757
Miller, David M., 164
Monk, Lorna S., 1016
Monson, Russell K., 1063
Moore, Brandon D., 978
Morell, Matthew K., 182
Morgan, Page W., 615
Morré, D. James, 1151
Motto, Mario, 720
Mullet, John E., 261
Mullins, Michael G., 419

N

Nable, Ross, 469
Nagano, Eiki, 1146
Nakano, Yoshiyuki, 294
Navon, Gil, 716
Neales, Tom F., 554
Nelson, Curtis J., 290, 548
Newcomb, John R., 898
Nieman, Richard H., 984
Nieman, Ronald A., 588
Nikolau, Basil J., 167
Nishi, Arasuke, 601
Nishimura, Mikio, 440
Nock, Linda P., 1079
Noguchi, Hisashi, 379
Noiton, Dominique, 419
Norman, Helen A., 684
Núñez de Castro, Ignacio, 1036

O

Oaks, Ann, 375
Ohashi, Yuko, 942
Ojalvo, Israel, 716
Oscarson, Petter, 860, 865
Oshima, Masahiro, 942
Oshio, Hiromichi, 1146
Osiewacz, Heinz D., 1021
Outlaw, William H., Jr., 1059
Ozeki, Yoshihiro, 942

P

Paech, Christian, 91
Palma, José M., 570
Pan, Rong Long, 158
Pan, Run Sun, 158
Paz, Nachman, 277
Pearce, David, 46, 605
Pearcy, Robert W., 355
Pech, Jean-Claude, 400
Perkin, Jean L., 268
Peterson, Todd A., 984
Peumans, Willy J., 566
Pfaffmann, Helmut, 1151
Pfankoch, Ed, 529
Pfanz, Hardy, 922, 928
Pharis, Richard P., 46, 605
Pharr, David M., 592
Pick, Uri, 194
Pier, Paul A., 655
Pilet, Paul-Emil, 8
Pilet, Paul-Emile, 42
Piñas, Francisca Fernandez, 585
Plaut, Zvi, 786
Plumley, F. Gerald, 638
Plummer, Julie A., 419
Poljakoff-Mayber, Alexandra, 383
Poole, Ronald J., 30
Porter, Gregory A., 558
Portis, Archie R., Jr., 152
Potter, John R., 1089
Potter, Sandra W., 1089
Poulle, M., 375
Pradet, Alain, 383
Prasad, Tottempudi K., 104
Preiss, Jack, 182, 360
Press, Malcolm C., 1143

Prins, Hidde B. A., 239
Proebsting, William M., 1089
Pupillo, Paolo, 828

Q

Quinby, J. Roy, 615

R

Raboy, Victor, 841
Radin, John W., 588
Rappaport, Lawrence, 212, 934
Rausch, Thomas, 996
Rauser, Wilfried E., 62
Ray, Peter M., 523
Read, Steve M., 1008
Regnier, Fred E., 529
Reinhold, Leonora, 786, 872
Reuveni, Moshe, 383
Reymond, Philippe, 8
Reynolds-Niesman, Ingrid, 1129
Rhodes, David, 174
Robbins, N. Suzanne, 592
Robinson, Nina L., 360
Rodis, Panayotis, 516
Roeckel, Patricia, 876
Rohwer, Frauke, 34
Rokem, J. Stefan, 716
Rood, Stewart B., 605
Ross, Gavin S., 46
Rubinstein, Bernard, 318, 872
Ruiz-Cristin, Jose, 1137

S

Sage, Rowan F., 355
Saini, Hargurdeep S., 155
Sakoda, Masako, 379
Sala, Mario, 720
Salvi, Giovanni, 626, 631
Salvucci, Michael E., 66
Sando, Seiji, 379
Sandstrom, Richard P., 693
Sato, Ryo, 1146
Satter, Ruth L., 850
Saugy, Martial, 8, 42
Saville, Barry, 26
Schauf, Charles L., 413
Scheel, Dierk, 34
Scheller, Henrik V., 1031
Schmalstig, J. Gougler, 407
Schmalstig, Judy Gougler, 902
Schmidt, Gregory W., 638
Schnyder, Hans, 290, 548
Schuler, Mary, 457
Schuster, William S., 1063
Seemann, Jeffrey R., 355
Sen Gupta, Ashima, 1040
Servaites, Jerome C., 365, 370
Setter, Tim L., 990
Shaaltiel, Yoseph, 869
Shafer, Warren E., 965
Shah, Nishith, 1143
Shannon, Jack C., 558
Shimabukuro, Richard H., 188
Shumsky, Jed S., 22
Siedow, James N., 474
Silverman, David N., 72
Sindhu, Ram K., 916
Singh, Jas, 699
Singh, Narendra K., 529
Sligar, Stephen G., 457
Sloan, Margaret E., 516
Smith, Julie K., 1110
Solomonson, L. P., 375
Solomos, Theophanes, 804
Spaeth, Stephen C., 217
Spencer, Mary S., 155
Spiller, Hart, 72
Staehelin, L. Andrew, 487
Stafford, Alan E., 115
Stafford, Allan E., 212
Stein, Diana B., 318
Stetler, David A., 343
Stewart, George R., 1143
St. John, Judith B., 684
Straus, Neil, 26
Streeter, John G., 768, 774
Streusand, V. J., 152
Struck, Friedhelm, 124
Stults, John T., 726
Sturm, Arnd, 741
Szumilo, Taduesz, 741

T

Taiz, Lincoln, 996
Takada, Mitsuo, 379
Tamot, B. K., 10
Tanaka, Yoshiyuki, 942
Tanoue, Chikako, 379
Tapia, Luis, 667
Tarczynski, Mitchell C., 1059
Taylor, Janet, 34
Teller, Gerard, 393
Templeman, Thomas S., 343
Tenhunen, John D., 109
Thellier, Michel, 608
Thomas, Martine, 243
Thompson, John E., 204, 679
Ting, Irwin P., 481
Torii, Naohiro, 906
Treeby, Michael T., 331
Triplett, Eric W., 335
Tsai, Mai Yu, 158
Tsurusawa, Yutaka, 601
Tu, ChingKuang, 72
Tucci, Michelle A., 365, 370
Tuohy, Janet M., 1143

U

Ullmann, Pascaline, 51
Ullrich-Eberius, Cornelia I., 674

V

Valenti, Vincenzo, 828
Valiente, Eduardo Fernandez, 585
Valpuesta, Victoriano, 1036
Vance, Carroll P., 283
Van Damme, Els J. M., 566
Vanden Born, William H., 82
van Huystee, Robert, 299
Van Steveninck, Reinhard F. M., 331
Verderio, Alberto, 720
Vertucci, Christina W., 224, 232
Vessey, J. Kevin, 137
Vick, Brady A., 1073
Vidal, Jean, 243
Vine, John H., 419
Voet, Judith G., 22

W

Wada, Keishiro, 446
Wagner, Walter, 706
Walker, Mark A., 78
Walsh, Kerry B., 137
Walton, Daniel C., 910, 916
Wang, May Yun, 158
Wasserman, Bruce P., 516
Watad, Abd-Elrahem A., 174
Watkins, Christopher B., 56
Weber, James A., 109
Wedding, Randolph T., 497
Weiler, Elmar W., 835
Welch, Ross M., 801
Wetering, Dirk A. M. van de, 310
Wheeler, Jeffery J., 389
Whiteley, H. R., 1103
Wiemken, Andres, 706
Williamson, Richard E., 268
Wilson, Clyde, 423
Wilson, Kathryn J., 413
Wilusz, Edward J., 711
Winter, Klaus, 1000
Woo, K. C., 621
Wright, John P., 188
Wu, Jingrui, 978
Wu, Min-Xian, 497
Wycoff, Keith L., 508
Wynns, George C., 72

X

Xu, Yujia, 850

Y

Yamada, Yasuyuki, 145
Yamamoto, Naoki, 942
Yanagisawa, Hiroshi, 906
Yáñez, Juan, 570
Yang, Ning-Sun, 1103
Yang, Shang Fa, 643
Yip, Wing-Kin, 643
Yuan, Xiao-Hua, 598

Z

Zeevaart, Jan A. D., 87, 726
Zetsche, Klaus, 124
Zilinskas, Barbara A., 322
Zimmerman, Don C., 1073

Plant Physiol. (1987) 85, xxv–xxxv
0032-0889/87/85/xxv/11/$01.00/0

Subject Index

A

Abscisic acid
biosynthesis
Xanthium strumarium leaves and roots, 726
xanthophylls and, water-stressed bean leaves, 910
freezing tolerance induction, altered gene expression, rapeseed, 699
indirect enzyme linked immunoassay development, 46
indole-3-acetic acid and, simultaneous quantitation, apple/prune/orange, 419
intracellular pH, cotton fruit development, NMR spectroscopy, 588
osmotic adjustment stimulation, sodium chloride adaptation, tobacco, 174
quantification, single maize root, 8
Acetate
light and, regulation in algae, mitochondrial malate dehydrogenase, 124
metabolism, NMR spectroscopy, corn, 463
Acetolactate synthase
plant gene code, herbicides, tobacco, 1110
resistance to herbicide sulfometuron methyl, mutations in *Chlamydomonas reinhardtii*, 898
β-*N*-Acetylhexosaminidase, isozymes, pea, 1118
Actin, *Chara* giant internodal cells, 268
Adenine, metabolism, salt-stressed corn root tips, 984
Adenosine triphosphatase
calcium transport in sealed vesicles, red beet storage tissue, 1129
plasma membrane H^+-ATPase, aqueous phase partitioning, oat, 693
Adenosine triphosphate
activation of ribulose bisphosphate carboxylase, rubisco activase, spinach, 152
osmotically-induced proton extrusion, carrot cells, 383
S-Adenosylmethionine decarboxylase, subcellular localization of amines, *p*-fluorophenylalanine, tobacco, 78
ADPglucose pyrophosphorylase, subunit structure, spinach leaf, 182
Agrostis gigantea (*see* Grass)
Alanine, proton cotransport, membrane potential, *Lemna gibba*, 674
Alcohol dehydrogenase, *Nco*I cassette vector, maize, 327
Alfalfa
roots and nodules, nonphotosynthetic carbon dioxide fixation, 283
seedling, phosphorus-stressed, organic acid exudates, 315
Algae
light and acetate regulation, mitochondrial malate dehydrogenase, 124
light/dark changes, photosystem II, *Dunaliella salina*, 194
locale, L-*myo*-inositol-1-phosphate synthase, chloroplast, 611
Allantoin, effect of oxygen, purine-catabolizing enzymes, soybean, 452
Alliin lyase, physical properties, garlic and onion, 1079
Allium cepa (*see* Onion)
Allium sativum (*see* Garlic)
Amaranthus edulis, leaf, fructose 2,6-bisphosphate, synthesis and degradation, 13
Amaranthus hypochondriacus, regulation, ribulose 1,5-bisphosphate carboxylase gene expression, 167
Amaranthus retroflexus, nitrogen use efficiency, 355
Amiloride, analogs of, inhibited Na^+/H^+ antiport activity, sugar beet tonoplast, 30
Amines, subcellular localization, *p*-fluorophenylalanine, tobacco, 78
Amino acids
assimilate unloading, maize pedicel tissues, 558
dihydrodipicolinate synthase, purification and characterization, wheat, 145
effect of nitrate, legume nodules, 774
free, content, setting and aborting soybean ovaries, 91
metabolite concentrations, bacteroids and cytosol, soybean nodules, 768
tabtoxinine-β-lactam transport, corn cells, 845
1-Aminocyclopropane-1-carboxylic acid, metabolism in etiolated wheat seedling leaves, effect, light and phytochrome, 643
Ammonia, assimilation, glutamate transport, spinach chloroplasts, 621
Ammonium, nitrogen utilization, *Lemna gibba*, 865
Anabaena
nitrogenase genes, contiguous organization, 26
sodium requirement, photosynthesis, dinitrogen fixation, 585
Andropogon glomeratus, effect of salinity, leaf gas exchange, 1055
Antibodies, anti-H^+-ATPase, glucose transport, tonoplast of corn, 996
Antioxidants, somatic embryo development, wild carrot, 273
Antiport, Na^+/H^+, amiloride analogs, sugar beet tonoplast, 30
Apium graveolens (*see* Celery)
Apple, simultaneous quantitation, indole-3-acetic acid, abscisic acid, 419
Arabidopsis thaliana, differential effects of BASF 13-338, monogalactosyldiacylglycerol synthesis, 684
Arachis hypogaea (*see* Peanut)
Arbutus unedo, photosynthetic photon flux density, carboxylation efficiency, 109
Arginine decarboxylase, subcellular localization of amines, *p*-fluorophenylalanine, tobacco, 78
Asclepias tuberosa, protoplasts, single potassium and chloride channels, 413
Ascorbate peroxidase, Hill reaction, hydrogen peroxide scavenging, C_4 plants, 294
Ascorbic acid, somatic embryo development, antioxidants, wild carrot, 273
Aspergillus niger, elicitation of necrosis, *Vigna unguiculata*, 626
Assays
indirect enzyme linked immunoassay, development, abscisic acid, 46
measurement errors, unsupported roots, corn, 164
Assimilates, unloading, maize pedicel tissues, 558
ATP (*see* Adenosine triphosphate)
Atriplex spongiosa, C_4 acid decarboxylases and photosynthesis, 952
Auxin
-deprived pear cells, protein synthesis, quiescence and senescence, 400
macromolecule biosynthesis, β-glucan synthase activity, pea, 523
master regulatory genes, sexual organogeneses, *Mercurialis annua*, 393
5′-Azido-*N*-1-napthylphthalamic acid, synthesis and binding properties, *Curcurbita pepo*, 22

B

Bacillus thuringiensis, δ-endotoxin, resistance to lepidopteran insects, tobacco, 1103
Bacteroids, cytosol and, metabolite concentrations, soybean nodules, 768
Banana, ripening, 277
Barley
aleurone cells, lipase transfer, 487
enzymology of fructan synthesis, 706
leaf
sodium dioxide fluxes, cellular acidification, 928
sulfur dioxide fluxes, mesophyll resistances, 922
nickel as essential micronutrient, 801
phosphoenolpyruvate carboxylase, comparative studies, 947
Barnyard grass, mitochondrial activity, aerobic and anaerobic conditions, 474
BASF 13-338
differential effects, monogalactosyldiacylglycerol synthesis, *Arabidopsis thaliana*, 684
treated wheat seedlings, cation-induced changes, 17
Bean
cotyledons, pressure-driven extrusion, 217
effect of nitrate, organic acid and amino acid composition, 774
elicitor-treated, ^{31}P NMR study, 716
Golgi enzymes, oligosaccharide modification, 741
leaf
conversion of xanthoxin, abscisic acid, 916
water stress, xanthophylls and abscisic acid biosynthesis, 910
phosphatidylinositol-specific phospholipase C, 1151
polygalacturonase-inhibiting protein, purification, characterization, 631
root, superoxide radical, extracellular ferric

reduction, 310
root surface peroxidase, effect, *Pseudomonas putida* colonization, 537
source photosynthesis, effect of altered sink:source ratio, 786
Beet
inhibited Na^+/H^+ antiport activity, amiloride analogs, 30
leaf
glyphosate effects, gas exchange, 365
glyphosate effects, ribulose bisphosphate carboxylase, 370
influence of mannose, apoplasmic retrieval systems, 423
leaf development, metabolism, sucrose synthase and invertase, 407
root, CHAPS solubilization, β-glucan synthesis, 516
vacuoles, microelectrode measurements, ionic leak effect, 608
Beta vulgaris (*see* Beet)
Brassica napus (*see* Canola, Rapeseed)
Brassica oleracea (*see* Collard)
Broad bean
acid-induced stomatal opening, role, guard cell wall elasticity, 554
seed, water binding, 224
stomatal opening, indoleacetic acid, ethrel, 318
Buckwheat, light- and dark-grown, fluence-response relationships, phototropism, 689
Bundle sheath cells, mechanism of C_4 photosynthesis, 958
Butyric acid, membrane potential, proton cotransport, *Lemna gibba*, 674

C

Cadmium, extracellular, compartmental efflux analysis, grass and corn roots, 62
Cajanus cajan (*see* Pigeonpea)
Calcium
asymmetry, gravitropism, pea epicotyls, 542
β-glucan synthase modulation, pea, 131
inhibition of (1→3)-β-glucan synthase, UDP-pyridoxal, mung bean, 1008
phosphatidylinositol breakdown, phytoalexin production, carrot cells, 601
transport in sealed vesicles, red beet storage tissue, 1129, 1137
Calcium chloride, role of potassium, growth maintenance, orange, 434
Callus, soybean, effect of oxygen, purine-catabolizing enzymes, 452
Cancer therapy, use of cytotoxic plant lectins, 1
C_3 and C_4 plants, *see also* specific types
intermediate, photosynthesis, *Flaveria brownii* A.M. Powell, 1063
phosphoenolpyruvate carboxylase, comparative studies, 947
Capsidiol, induction of sesquiterpenoid biosynthesis, fungal elicitor, tobacco, 469
Capsium annuum (*see* Pepper)
Carbohydrates
grain filling, photosynthetic gas exchange, wheat flag leaves and sheaths, 667
localization of metabolizing enzyme, *Commelina communis* guard cells, 360
metabolism, leaf growth, fescue, 548
metabolite concentrations, bacteroids and cytosol, soybean nodules, 768
Carbon
assimilation, glyphosate effects, sugar beet leaves, 365, 370
carbohydrate metabolizing enzyme, localization, *Commelina communis* guard cells, 360
flux, isotope ratios, C_4 host to C_3 parasite, 1143
inorganic, carbonic anhydrase, *Synechococcus*, 72
intracellular partitioning, *Chlamydomonas reinhardtii*, 892
photosynthetic metabolism, light intensity, cucumber, 592
Carbon dioxide
banana ripening, 277
bundle sheath cells, mechanism of C_4 photosynthesis, 958
light responses of photosynthesis, water deficit and recovery, cowpea and pigeonpea, 990
nonphotosynthetic fixation, alfalfa roots and nodules, 283
Carbonic anhydrase, inorganic carbon uptake, *Synechococcus*, 72
Carboxylation, efficiency, photosynthetic photon flux density, spinach/soybean/*Arbutus unedo*, 109
Carnation
flower, senescence, membrane deterioration, 204
senescing flowers, phospholipid breakdown, molecular species specificity, 679
Carrot
fusogenic, presence of polyphophoinositides, plasma membranes, 389
osmotically-induced proton extrusion, 383
phytoalexin production, phosphatidylinositol breakdown, 601
wild, somatic embryo development, antioxidants, 273
Cassette vector, *Ncol*, *Adh1* based, maize, 327
Castor bean
binding of antilipase to 62 kD protein, 1084
endosperm, glyoxysomal membrane redox orientation, 796
glyoxysomal NADH oxidation, 792
source photosynthesis, effect of altered sink:source ratio, 786
Catecholamines, promotion of flowering, short-day duckweed, 10
Catharanthus roseus, comparmentation, indole alkaloid biosynthesis, 1099
Cations
exchange, mass-action expressions, collard leaves, 247
peanut peroxidase, monoclonal antibodies, 299
C_3-C_4
leaves, fructose 2,6-bisphosphate, synthesis and degradation, 13
nitrogen use efficiency, 355
Celery, phloem segments of, glucose, facilitated transport, 711
Cell wall
cation exchange, mass-action expressions, collard leaves, 247
elasticity, acid-induced stomatal opening, broad bean, 554
proteins, low water potentials, soybean, 261
Cereals, nickel as essential micronutrient, 801
CHAPS, solubilization and functional reconstitution, β-glucan synthase, red beet root, 516
Chara corallina, giant internodal cells, actin, 268
Chelators, characterization of iron uptake, ferrioxamine B, *Chlorella vulgaris*, 746, 751
Chenopodium album, nitrogen use efficiency, 355
Chlamydomonas reinhardtii
intracellular carbon partitioning, 892
mutations, resistance to herbicide sulfometuron methyl, 898
Chloramphenicol acetyl transferase, *Adh1* based *Ncol* cassette vector, maize, 327
Chlorella vulgaris
characterization
nitrate reductases, 375
iron uptake, ferrioxamine B, 746, 751
Chloride channel, properties, *Asclepias tuberosa* protoplasts, 413
2-(Chloroethyl)phosphonic acid, uptake and fate, dormant weed seeds, 155
Chlorogonium elongatum (*see* Algae)
Chlorophyll
light/dark changes, photosystem II, *Dunaliella salina*, 194
light-harvesting protein biosynthesis, regulation, greening seedlings, 971
Chloroplasts
Catharanthus roseus, indole alkaloid biosythesis, compartmentation, 1099
Chara corallina, giant internodal cells, actin, 268
Conyza, resistance to paraquat, kinetic analysis, 869
corn, coupling factor one, nuclear gene-regulated expression, 757
C_4 plants, Hill reaction, hydrogen peroxide scavenging, 294
Euglena gracilis and mung bean, locale, L-*myo*-inositol-1-phosphate synthase, 611
Mougeotia, orientation, green and far-red light, 581
pea
phosphorylation, photosystem II components, 638
photosynthetic induction, glucose-6-phosphate dehydrogenase, 598
surface protein binding, ribulose-1,5-bisphosphate carboxylase, 780
spinach
ammonia assimilation, glutamate transport, 621
functional size, photosynthetic electron transport chain, 158
phosphorylation, photosystem II components, 638
spinach leaf, pathways, fatty acid hydroperoxide metabolism, 1073
water stress effects, photosynthesis, wheat, 1040
Chlosulfuron, uptake and accumulation, pea root, 82
3-[(3-Cholamidopropyl)dimethylammonio]-1-propane sulfonate (*see* CHAPS)
Chromatography, anion exchange, gibberellin A_1 binding, corn, 934
Cicer arietinum (*see* Garbanzo bean)
Citrate, exudates, phosphorus-stressed alfalfa seedling, 315
Citrus aurantium (*see* Orange)
Citrus sinensis (*see* Orange)
Clopyralid, uptake and accumulation, pea

root, 82
Clover, trifolitoxin production, nodulation competitiveness, *Rhizobium leguminosarum*, 335
Coleoptiles
corn, UDP-glucose β-D-glucosyl transferase, phospholipids, 51
wheat and oat, membrane potentials, diclofop and diclofop-methyl, 188
Collard, leaf, cation exchange, mass-action expressions, 247
Commelina communis, guard cells, localization, carbohydrate metabolizing enzymes, 360
Conyza, resistance to paraquat, kinetic analysis, 869
Copper, tolerant pea plants, peroxisomal active oxygen enzymes, 570
Corn
Adh1 based *Nco*I cassette vector, 327
binding of antilipase to 62 kD protein, 1084
C_4 acid decarboxylases and photosynthesis, 952
characterization, acetate and pyruvate metabolism, NMR spectroscopy, 463
chloroplast genes for coupling factor one, nuclear gene-regulated expression, 757
gibberellin A_1 binding, 934
Hill reaction, hydrogen peroxide scavenging, ascorbate peroxidase, 294
isolation, hydroxyproline-rich glycoprotein, graminaceous monocot, 823
leaf
characterization, nitrate reductases, 375
genotype-dependent senescence, 720
mitochondria, transcription, RNA synthesis inhibitors, 304
pedicel tissues, assimilate unloading, chemical agent effects, 558
phosphoenolpyruvate carboxylase, comparative studies, 947
pollen grains, isolation, viable sperm cells, 876
regulation by phospholipids, UDP-glucose β-D-glucosyl transferase, kinetic studies, 51
root
abscisic acid quantification, 8
damage from lack of support, transfer between solutions, 164
ester and free indol-3yl-acetic acid, growth, 42
extracellular cadmium, compartmental efflux analysis, 62
root tips, salt stress, nucleotide metabolism, 984
seedling, thermotolerance, heat shock proteins, 575
tabtoxinine-β-lactam transport, 845
temperature effects, phosphoenolpyruvate carboxylase, 497
tonoplast membrane, glucose transport, proton pumping, 996
Cotton
binding of antilipase to 62 kD protein, 1084
plasmalemma-enriched vesicles, generation of membrane potential, electron transport, 872
source photosynthesis, effect of altered sink:source ratio, 786
Cotyledons
Amaranthus hypochondriacus, ribulose 1, 5-bisphosphate carboxylase regulation, 167
bean, pressure-driven extrusion, 217
cucumber seedling, wavelength effect, diphenylether-type herbicidal action, 1146
pea, pressure-driven extrusion, 217
pumpkin, proglobulin processing enzyme, vacuoles, 440
4-Coumarate, phenylalanine ammonia-lyase and, mRNA induction in potato, *Phytophthora infestans*, 34
Coupling factor one, nuclear gene-regulated expression, chloroplast genes, maize, 757
Cowpea
elicitation of necrosis, 626
epicotyls, exogenous gibberellins, phytochrome regulation, 212
gas exchange, water stress and recovery, 990
heat shock proteins, thermoadaptation, 4
seed, water binding, 224
C_4 plants, chloroplasts, Hill reaction, hydrogen peroxide scavenging, 294
Crassula argentea, temperature effects, phosphoenolpyruvate carboxylase, 497
Crassulacean acid, metabolism in *Kalanchoë daigremontiana*, fluorescence quenching, 1000
Cucumber
photosynthetic carbon metabolism, light intensity, photosynthetic period, 592
seedling, wavelength effect, diphenylether-type herbicidal action, 1146
source photosynthesis, effect of altered sink:source ratio, 786
Cucumis sativus (*see* Cucumber)
Cucurbita pepo (*see* Squash, Zucchini)
Cucurbita (*see* Pumpkin)
Cultivars, soybean, sink removal, leaf senescence, 662
Cuticles, tomato, sorption of triton X-100, octylphenoxy surfactants, 965
Cyanobacteria
inactivation of *psbA* gene family, 1021
nitrogenase genes, contiguous organization, 26
sodium requirement, photosynthesis, dinitrogen fixation, 585
Synechococcus, carbonic anhydrase, inorganic carbon uptake, 72
Cytochrome b_5, microsomal, characterization, pea, 457
Cytochrome *c*
glyoxysomal NADH oxidation, castor bean, 792, 796
NAD(P)H dehydrogenase, solubilization and purification, squash microsomes, 828
Cytoplasm, *Lupinus luteus* leaflets, phosphorus concentrations, 331
Cytosol, bacteroids and, metabolite concentrations, soybean nodules, 768

D

Densitometry, nanogram quantities of proteins, one-dimensional microslab gels, 1059
Deoxyribonucleic acid
full-length cDNA, pathogenesis-related proteins, tobacco, 942
nitrogenase genes, contiguous organization, cyanobacteria, 26
Desiccation, tolerance, water binding, soybean and ferns, 232
Dicarboxylates, glutamate transport, ammonia assimilation, spinach chloroplasts, 621
Diclofop, diclofop-methyl and, membrane potentials, wheat and oat coleoptiles, 188
Dihydrodipicolinate synthase, purification and characterization, wheat suspension cultures, 145
Diphenylether, herbicidal action, wavelength effect, cucumber seedling, 1146
DNA (*see* Deoxyribonucleic acid)
Drought (*see* Water stress)
Duckweed, short-day, flowering promotion, catecholamines, 10
Dunaliella salina (*see* Algae)

E

Echinochloa crusgalli, bundle sheath cells, mechanism of C_4 photosynthesis, 958
Echinochloa crus-galli (*see* Barnyard grass)
Eggplant, source photosynthesis, effect of altered sink:source ratio, 786
Eichhornia crassipes (*see* Water hyacinth)
Electron transport, generation of membrane potential, plasmalemma-enriched vesicles, cotton and radish, 872
Eleusine indica, bundle sheath cells, mechanism of C_4 photosynthesis, 958
Elicitors
proteinaceous, *Phytophthora parasitica*, tobacco callus, 733
treated bean, ^{31}P NMR study, 716
Elodea canadensis, leaf, light induced polarity, redox reactions, 239
Embryogenesis, antioxidants, wild carrot, 273
Endoplasmic reticulum, calcium transport in sealed vesicles, red beet, 1129
Endo-polygalacturonase
Aspergillus niger, elicitation of necrosis, *Vigna unguiculata*, 626
polygalacturonase-inhibiting protein, characterization, bean, 631
Endosperm
castor bean, glyoxysomal membrane redox orientation, 796
corn, sucrose analog transport, no invertase hydrolysis, 902
Enzymes, glycolytic, banana ripening, 277
Epicotyls
cowpea, exogenous gibberellins, phytochrome regulation, 212
pea, calcium asymmetry, gravitropism, 542
Epinephrine, promotion of flowering, catecholamines, short-day duckweed, 10
Ethephon, uptake and fate, dormant weed seeds, 155
Ethrel, indoleacetic acid and, promotion of stomatal opening, broad bean, 318
Ethylene
1-aminocyclopropane-1-carboxylic acid metabolism, effect of light and phytochrome, wheat seedling leaves, 643
banana ripening, 277
galactose-stimulated, tomato, 804
induced glycoprotein and lignin, stem elongation, morning glory, 104
promotion of stomatal opening, indoleacetic acid and ethrel, broad bean, 318
uptake and fate of ethephon, dormant weed seeds, 155
Euglena gracilis, chloroplast, locale, L-*myo*-

inositol-1-phosphate synthase, 611
Extensin, isolation of hydroxyproline-rich glycoprotein, graminaceous monocot, corn, 823
Extrusion, pressure-driven, bean and pea cotyledons, 217

F

Fagopyrum esculentum (*see* Buckwheat)
Fatty acids
hydroperoxide metabolism, spinach leaf chloroplasts, 1073
ice encasement injury, microsomal membranes, winter wheat crowns, 1068
Ferns
spore germination, globulin storage proteins, 343
water binding, desiccation tolerance, 232
Ferricyanide reductase, glyoxysomal NADH oxidation, castor bean, 792, 796
Ferrioxamine B, characterization of iron uptake, *Chlorella vulgaris*, 746, 751
Fescue
leaf growth
carbohydrate metabolism, 548
distribution, 290
Festuca arundinacea (*see* Fescue)
Fischerella, nitrogenase genes, contiguous organization, 26
Flaveria brownii, photosynthesis, 1063
Flaveria trinervia, Hill reaction, hydrogen peroxide scavenging, ascorbate peroxidase, 294
Flavonol, glycoside genes, soybean leaf traits, 20
Flower
carnation
senescence, membrane deterioration, 204
senescence, phospholipid breakdown, 679
setting and aborting soybean ovaries, free amino acid content, 91
Flowering
genetic control of development, *Sorghum bicolor*, 615
promotion of, catecholamines, duckweed, 10
sink removal, leaf senescence, soybean, 662
Fluorescence, quenching, crassulacean acid metabolism, *Kalanchoë daigremontiana*, 1000
p-Fluorophenylalanine, subcellular localization of amines, tobacco cell cultures, 78
1′-Fluorosucrose, transport and metabolism, no invertase hydrolysis, corn endosperm, 902
Foliage, temperature effect, water deficit and glutathione reductase, winter wheat, 100
Freezing, tolerance induction, altered gene expression, rapeseed, 699
Fructan, synthesis, enzymology, barley, 706
Fructose 2,6-bisphosphate
banana ripening, 277
synthesis and degradation, C_3 and C_4 leaves, not liver, 13
Fusicoccin
macromolecule biosynthesis, β-glucan synthase activity, pea, 523
monoclonal antibodies, microsomal binding assay, 835

G

Galactose, stimulated ethylene production, tomato, 804
α-D-Galacturonate oligomers, elicitation of necrosis, *Aspergillus niger*, *Vigna unguiculata*, 626
Garbanzo bean, binding of antilipase to 62 kD protein, 1084
Garlic, physical properties of alliin lyase, 1079
Gas chromatography, simultaneous quantitation, indole-3-acetic acid and abscisic acid, apple/prune/pear, 419
Gas exchange
glyphosate effects, sugar beet leaves, 365
grain filling, wheat flag leaf blades and sheaths, 667
leaf, effect of salinity, C_4 nonhalophyte, 1055
water stress and recovery, cowpea and pigeonpea, 990
Gas flow, pressurization, *Nelumbo* leaves, 199
Genes
Adh1 based *Nco*I cassette vector, maize, 327
altered expression, freezing tolerance induction, rapeseed, 699
coding for acetolactate synthase, herbicides, tobacco, 1110
glycoprotein antigens, monoclonal antibodies, fungal plant pathogen, 508
psbA, inactivation, cyanobacterium *Synechocystis* 6803, 1021
regulatory, sexual organogeneses, *Mercurialis annua*, 393
smr-1, herbicide resistance, *Chlamydomonas reinhardtii*, 898
Germination, photoinduced, *Oenothera biennis* seed, 879, 885
Gibberellic acid
genetic control of development, *Sorghum bicolor*, 615
lipase transfer, protein bodies to lipid bodies, barley aleurone cells, 487
Gibberellin A_1, binding in corn, 934
Gibberellin oxidases, partial purification, spinach leaves, 87
Gibberellins
endogenous, identification, oilseed rape, 605
exogenous, phytochrome regulation, cowpea epicotyls, 212
Globulins
proglobulin processing enzyme, vacuoles, developing pumpkin cotyledons, 440
storage proteins, spore germination, *Matteuccia struthiopteris*, 343
Glomus mosseae
effects of mycorrhiza on nodule activity, drought stress, soybeans, 115
mycorrhiza and photosynthesis, N- and P-fertilized soybean plants, 120
Glucan, treated bean, ^{31}P NMR study, 716
β-Glucan synthase
CHAPS solubilization and functional reconstitution, red beet root, 516
macromolecule biosynthesis, auxin and fusicoccin enhancement, pea, 523
modulation by calcium, polycations and protease, pea, 131
(1→3)-β-Glucan synthase, inhibition of UDP-glucose, UDP-pyridoxal, mung bean, 1008
Glucose
facilitated transport, phloem segments of celery, 711
transport and proton pumping, tonoplast membrane, corn, 996
Glucose-6-phosphate dehydrogenase, changing activity, photosynthetic induction, pea chloroplasts, 598
Glutamate, transport, ammonia assimilation, spinach chloroplasts, 621
Glutamate synthases, different characteristics, green leaves, tomato, 1036
Glutathione, phytochelatin synthesis, response to heavy metals, tomato cells, 1031
Glutathione reductase, foliage temperature effect, water deficit, winter wheat, 100
Glycine max (*see* Soybean)
Glycoproteins
antigens, monoclonal antibodies, fungal plant pathogen, 508
ethylene-induced, stem elongation, morning glory, 104
hydroxyproline-rich, graminaceous monocot, corn, 823
Glycosidases, subcellular localization, N-linked oligosaccharides, bean, 741
Glycosides, flavonol, soybean leaf traits, 20
Glycosyltransferases, subcellular localization, N-linked oligosaccharides, bean, 741
Glyoxysomal lipase, binding of antilipase to 62 kD protein, oilseed plants, 1084
Glyoxysomes
membrane redox orientation, castor bean endosperm, 796
NADH oxidation, castor bean, 792
Glyphosate, effects on carbon assimilation
gas exchange, sugar beet leaves, 365
ribulose bisphosphate carboxylase, sugar beet leaves, 370
Golgi enzymes, oligosaccharide modification, bean, 741
Gossypium hirsutum (*see* Cotton)
Grain filling, wheat flag leaf blades and sheaths, gas exchange patterns, 667
Grass, root, extracellular cadmium, compartmental efflux analysis, 62
Gravitropism, calcium asymmetry, pea epicotyls, 542
Greening, plastid development, pea leaf, 808, 816
Guard cells, *Commelina communis*, localization, carbohydrate metabolizing enzymes, 360

H

H^+-ATPase
glucose transport, tonoplast membrane, corn, 996
plasma membrane latency, aqueous phase partitioning, oat, 693
Heat shock proteins
thermoadaptation, cowpea cells, 4
thermotolerance, maize, 575
Herbicides
BASF 13-338, monogalactosyldiacylglycerol synthesis, *Arabidopsis thaliana*, 684
chlorsulfuron and clopyralid, uptake and accumulation, pea root, 82
diclofop and diclofop-methyl, membrane potentials, wheat and oat coleoptiles, 188
diphenylether acifluorfen-ethyl, wavelength effect, cucumber seedlings, 1146

genes coding for acetolactate synthase, tobacco, 1110
sulfometuron methyl, resistance, mutations in *Chlamydomonas reinhardtii*, 898
Hill reaction, hydrogen peroxide scavenging, ascorbate peroxidase activity, C_4 plants, 294
Histochemistry, densitometry of nanogram quantities of proteins, one-dimensional microslab gels, 1059
Hordeum vulgare (*see* Barley)
Hydrogen peroxide, scavenging, Hill reaction, C_4 plants, 294
Hydroperoxide lyase, metabolism, pathways of, spinach leaf chloroplasts, 1073
Hydroxyproline, glycoprotein isolation, graminaceous monocot, corn, 823
Hypocotyls, radish, phototropism, 379

I

Ice, *see also* Freezing
encasement, injury to microsomal membranes, winter wheat crowns, 1068
Imbibition, pressure-driven extrusion, bean and pea cotyledons, 217
Immunoassays (*see* Assays)
Immunoglobulins, monoclonal antibodies, cationic peanut peroxidase, 299
Indole-3-acetic acid
abscisic acid and, simultaneous quantitation, apple/prune/orange, 419
calcium asymmetry, gravitropism, pea epicotyls, 542
effect of *Pseudomonas putida* colonization, root surface peroxidase, bean, 537
ethrel and, promotion of stomatal opening, broad bean, 318
macromolecule synthesis, β-glucan synthase activity, pea, 523
Indole alkaloid biosynthesis, compartmentation, *Catharanthus roseus*, 1099
Indol-3yl-acetic acid, ester and free, changes, growing maize roots, 42
Inorganic phosphate (*see* Phosphate)
L-*myo*-Inositol-1-phosphate synthase, locale, chloroplast, mung bean and *Euglena gracilis*, 611
Insects, lepidopteran, resistance in tobacco, *Bacillus thuringiensis* δ-endotoxin, 1103
Invertase, sucrose synthase and, metabolism in developing leaves, soybean and beet, 407
Ion channels, potassium and chloride, properties, *Asclepias tuberosa* protoplasts, 413
Ion exchange, mass-action expressions, sorption on cell walls, collard leaves, 247
Ipomoea nil (*see* Morning glory)
Iris pseudacorus, recovery from oxygen deprivation, superoxide dismutase, 1016
Iron
characterization of uptake, ferrioxamine B, *Chlorella vulgaris*, 746, 751
deficient bean roots, superoxide radical, extracellular ferric reduction, 310
Isoleucine, acetate and pyruvate metabolism, NMR spectroscopy, corn, 463
Isoproterenol, promotion of flowering, catecholamines, short-day duckweed, 10

K

Kaempferol triglucoside, soybean leaf traits, 20
Kalanchoë daigremontiana, fluorescence quenching, crassulacean acid metabolism, 1000
Kernel, corn, assimilate unloading, pedicel tissues, 558
Kidney bean, binding of antilipase to 62 kD protein, 1084

L

Lactuca sativa (*see* Lettuce)
Leaf
amaranthus, fructose 2,6-bisphosphate, synthesis and degradation, 13
Amaranthus hypochondriacus, ribulose 1, 5-bisphosphate carboxylase regulation, 167
Arbutus unedo, photosynthetic photon flux density, carboxylation efficiency, 109
barley
fructan synthesis, enzymology, 706
sodium dioxide fluxes, cellular acidification, 928
sulfur dioxide fluxes, mesophyll resistances, 922
bean
conversion of xanthoxin, abscisic acid, 916
sink:source ratio, photosynthetic metabolism, 786
water stress, xanthophylls and abscisic acid biosynthesis, 910
beet
glyphosate effects, gas exchange, 365
glyphosate effects, ribulose bisphosphate carboxylase, 370
influence of mannose, apoplasmic retrieval systems, 423
metabolism, sucrose synthase and invertase, 407
castor bean, sink:source ratio, photosynthetic metabolism, 786
C_3-C_4, fructose 2,6-bisphosphate, synthesis and degradation, 13
C_4 nonhalophyte, effect of salinity, leaf gas exchange, 1055
collard, cation exchange, mass-action expressions, 247
Conyza, resistance to paraquat, kinetic analysis, 869
corn
characterization, nitrate reductases, 375
genotype-dependent senescence, 720
gibberellin A_1 binding, 934
temperature effects, phosphoenolpyruvate carboxylase, 497
cotton, sink:source ratio, photosynthetic metabolism, 786
Crassula argentea, temperature effects, phosphoenolpyruvate carboxylase, 497
cucumber, sink:source ratio, photosynthetic metabolism, 786
eggplant, sink:source ratio, photosynthetic metabolism, 786
Elodea canadensis, light induced polarity, redox reactions, 239
fescue
growth, carbohydrate metabolism, 548
growth distribution, 290
Kalanchoë daigremontiana, fluorescence quenching, crassulacean acid metabolism, 1000
lettuce, fructose 2,6-bisphosphate, synthesis and degradation, 13
Nelumbo, Knudsen-transitional flow, gas pressurization, 199
orchid, mannose-specific lectin, 566
Parthenium hysterophorus, photosynthetic characteristics, 978
pea
fructose 2,6-bisphosphate, synthesis and degradation, 13
plastid development during greening, 808, 816
pepper, sink:source ratio, photosynthetic metabolism, 786
potato, mRNA induction, *Phytophthora infestans*, 34
radish, sink:source ratio, photosynthetic metabolism, 786
sorghum
fructose 2,6-bisphosphate, synthesis and degradation, 13
photocontrol, phosphoenolpyruvate carboxylase, 243
soybean
carbohydrate supply, dinitrogen fixation, 137
far-red light reflection, assimilate partitioning, 350
metabolism, sucrose synthase and invertase, 407
nitric oxide emissions, 96
photosynthetic photon flux density, carboxylation efficiency, 109
senescence, sink removal, 662
traits, flavonol glycoside genes, 20
spinach
chloroplasts, fatty acid hydroperoxide metabolism, 1073
fructose 2,6-bisphosphate, synthesis and degradation, 13
gibberellin oxidases, partial purification, 87
photosynthetic photon flux density, carboxylation efficiency, 109
subunit structure, ADPglucose pyrophosphorylase, 182
tobacco, influence of mannose, apoplasmic retrieval systems, 423
tomato, characteristics, glutamate synthases, 1036
water hyacinth, polyamine oxidase, purification and properties, 906
wheat
effect of light and phytochrome, 1-aminocyclopropane-1-carboxylic acid metabolism, 643
flag leaf blades and sheaths, gas exchange patterns, 667
metabolization, elemental sulfur, 1026
modulation of water stress, photosynthesis, 655
winter wheat, water deficit, foliage temperature and glutathione reductase, 100
Xanthium strumarium, abscisic acid biosynthesis, 726
Leaflets
Lupinus luteus, phosphorus concentrations, 331
Samanea saman, temperature effects, proton secretion and uptake, 850
Lectins
cytotoxic, review, cancer therapy use, 1
mannose-specific, orchid leaves, 566
Legumes, seeds, water binding, 224
Lemna gibba
membrane potential, proton cotransport, permanent weak acids, 674
nitrogen utilization, 856, 860, 865

Lemna paucicostata 6746 (*see* Duckweed)
Lettuce, leaf, fructose 2,6-bisphosphate, synthesis and degradation, 13
Leucine, acetate and pyruvate metabolism, NMR spectroscopy, corn, 463
Light
  acetate and, regulation in algae, mitochondrial malate dehydrogenase, 124
  dark and, phototropism, buckwheat, 689
  gas exchange, water stress and recovery, cowpea and pigeonpea, 990
  glutamate transport, ammonia assimilation, spinach chloroplasts, 621
  green and far-red interaction, chloroplast orientation, *Mougeotia*, 581
  induced polarity, redox reactions, *Elodea canadensis* leaves, 239
  intensity, photosynthetic carbon metabolism, cucumber, 592
  photoinduced seed germination, *Oenothera biennis*, 879, 885
  photosystem II, light harvesting system, *Dunaliella salina*, 194
  phytochrome effect and, 1-aminocyclopropane-1-carboxylic acid metabolism, wheat seedling leaves, 643
  reflection of far-red, green leaves, assimilate partitioning in soybean, 350
  rubisco regulation, tobacco protoplasts, 66
  wavelength effect, diphenylether acifluorfen-ethyl, cucumber seedlings, 1146
Light-harvesting complex, chlorophyll protein biosynthesis, regulation in greening seedlings, 971
Lignin, stem elongation, shoot inversion inhibition, morning glory, 104
Lima bean, binding of antilipase to 62 kD protein, 1084
Lipase, transfer in barley aleurone cells, 487
Lipid peroxidation, ice encasement injury, microsomal membranes, winter wheat crowns, 1068
Lipoxygenase, membrane deterioration, senescing carnation flowers, 204
Listera ovata (*see* Orchid)
Lupinus luteus, leaflets, phosphorus concentrations, 331
Lycopersicon esculentum (*see* Tomato)
Lysine, dihydrodipicolinate synthase, purification and characterization, wheat, 145
Lysophosphotidylinositol, presence of polyphosphoinositides, fusogenic carrot cells, 389

M

Macromolecules, auxin and fusicoccin enhancement, β-glucan synthase activity, pea, 523
Magnesium, inhibition of (1→3)-β-glucan synthase, UDP-pyridoxal, mung bean, 1008
Maize (*see* Corn)
Malate
  exudates, phosphorus-stressed alfalfa seedling, 315
  glutamate transport, ammonia assimilation, spinach chloroplasts, 621
  proton secretion and uptake, temperature effects, *Samanea saman*, 850
Malate dehydrogenase, mitochondrial, light and acetate regulation, *Chlorogonium elongatum*, 124
Mannose
  apoplasmic retrieval systems, source leaves, beet and tobacco, 423
  inhibition, pear fruit ripening, 56
  specific lectin, orchid leaves, 566
Mass spectrometry, simultaneous quantitation, indole-3-acetic acid and abscisic acid, apple/prune/pear, 419
Matteuccia struthiopteris, spore germination, globulin storage proteins, 343
Medicago sativa (*see* Alfalfa)
Membrane
  deterioration, senescing carnation flowers, 204
  fluidity, UDP-glucose sterol β-D-glucosyl transferase, corn, 51
  pea, β-glucan synthase modulation, calcium/polycations and protease, 131
  potential
    diclofop and diclofop-methyl, wheat and oat coleoptiles, 188
    electron transport, vesicles of cotton and radish, 872
    proton cotransport, *Lemna gibba*, 674
Mercurialis annua, regulator genes and auxin levels, sexual organogeneses, 393
Mesophyll
  C_4 plants, Hill reaction, hydrogen peroxide scavenging, 294
  Lupinus luteus leaflets, phosphorus concentrations, 331
  resistances to sodium dioxide fluxes, barley leaves, 922
Metals, heavy, phytochelatin synthesis, tomato cells, 1031
6-Methoxymellein, phosphatidylinositol breakdown, carrot cells, 601
Microelectrodes, measurements, ionic leak effect, red beet vacuoles, 608
Microelectrophoresis, densitometry of nanogram quantities of proteins, one-dimensional microslab gels, 1059
Microsomes
  membranes, ice encasement injury, winter wheat crowns, 1068
  monoclonal antibodies, fusicoccin, 835
  squash, solubilization and purification, NAD(P)H dehydrogenase, 828
Mitochondria
  activity, aerobic and anaerobic conditions, barnyard grass, 474
  corn, transcription, RNA synthesis inhibitors, 304
Monoclonal antibodies
  characterization, cationic peanut peroxidase, 299
  fusicoccin, microsomal binding assay, 835
  glycoprotein antigens, fungal plant pathogen, 508
  indirect ELISA development, abscisic acid, 46
Monogalactosyldiacylglycerol, synthesis, differential effects of BASF 13-338, *Arabidopsis thaliana*, 684
Morning glory, stem elongation, shoot inversion inhibition, 104
Moss, *Tortula ruralis*, protein synthesis, rehydration, 1094
Mougeotia, chloroplast orientation, interaction, green and far-red light, 581
Mung bean
  chloroplast, locale, L-*myo*-inositol-1-phosphate synthase, 611
  inhibition of UDP-glucose, UDP-pyridoxal, 1008
Mycorrhiza
  effects on nodule activity, transpiration, soybeans under drought stress, 115
  photosynthesis, N- and P-fertilized soybean plants, 120

N

NADH, glyoxysomal oxidation, castor bean, 792
NADH-cytochrome b_5 reductase, microsomal cytochrome b_5, pea, 457
NADPH, purothionin reduction, thioredoxin system, wheat seed, 446
NAD(P)H dehydrogenase, solubilization and purification, squash microsomes, 828
NAD(P)H enzyme, glutamate synthases, characteristics, green leaves of tomato, 1036
NADP-malic enzyme, C_4 plants, Hill reaction, hydrogen peroxide scavenging, 294
N-1-Naphthylphthalamic acid, photolabile analog of, synthesis and binding, *Curcurbita pepo*, 22
Nelumbo, leaf, Knudsen-transitional flow, gas pressurization, 199
Nickel, essential micronutrient, higher plants, 801
Nicotiana rustica (*see* Tobacco)
Nicotiana tabacum (*see* Tobacco)
Nitrate
  nitrogen utilization, *Lemna gibba*, 856, 860, 865
  organic acid and amino acid composition, legume nodules, 774
Nitrate reductase
  characterization, corn leaves, *Chlorella vulgaris*, 375
  nitrogen utilization, *Lemna gibba*, 856
Nitric oxide, emissions, soybean leaves, 96
Nitrogen
  dinitrogen fixation, carbohydrate supply, soybean, 137
  efficiency of use, C_3 and C_4 plants, 355
  mycorrhiza and photosynthesis, soybean plants, 120
  nonphotosynthetic carbon dioxide fixation, alfalfa roots and nodules, 283
  utilization, *Lemna gibba*, 856, 860, 865
Nitrogenase, contiguous organization of genes, cyanobacteria, 26
Nodulation, competitiveness by *Rhizobium leguminosarum*, trifolitoxin production, clover, 335
Nodule
  alfalfa, nonphotosynthetic carbon dioxide fixation, 283
  soybean
    carbohydrate supply, dinitrogen fixation, 137
    metabolite concentrations, bacteroids and cytosol, 768
    mycorrhiza effects, transpiration, 115
    mycorrhiza, photosynthesis, 120
Norepinephrine, promotion of flowering, catecholamines, short-day duckweed, 10
Nuclear genes, chloroplast genes for coupling factor one, maize, 757
Nuclear magnetic resonance spectroscopy
  acetate and pyruvate metabolism, characterization, corn, 463
  elicitor-treated bean, 716
  intracellular pH, fruit development, cotton embryos, 588
Nucleotides, metabolism, salt-stressed corn root tips, 984

O

Oat
coleoptiles, membrane potentials, diclofop and diclofop-methyl, 188
latency of plasma membrane H^+-ATPase, aqueous phase partitioning, 693
Octylphenoxy surfactants, sorption of triton X-100, tomato fruit cuticles, 965
Oenothera biennis, photoinduced seed germination, 879, 885
Oilseed plants, binding of antilipase to 62 kD protein, 1084
Oleoresinosis, biochemistry of, pine, 1123
Oligosaccharides, modification, Golgi enzymes, bean, 741
Onion, physical properties of alliin lyase, 1079
Orange
polyethylene glycol-induced water stress, salt tolerance, resistance, 430
role of potassium in growth maintenance, sodium chloride, calcium chloride, 434
simultaneous quantitation, indole-3-acetic acid, abscisic acid, 419
Orchid, leaf, mannose-specific lectin, 566
Organelles, maize mitochondria, transcription, RNA synthesis inhibitors, 304
Organic acids
effect of nitrate, legume nodules, 774
metabolite concentrations, bacteroids and cytosol, soybean nodules, 768
Ornithine decarboxylase, subcellular localization of amines, *p*-fluorophenylalanine, tobacco, 78
Oryza sativa (*see* Rice)
Oryzicola (*see* Barnyard grass)
Osmosis, characterization of osmotin, tobacco, 529
Osmotic potential, water stress effects, photosynthesis, wheat, 1040
Osmotin, characterization, tobacco, 529
Ovaries, soybean, setting and aborting, free amino acid content, 91
2-Oxoglutarate, transport, ammonia assimilation, spinach chloroplasts, 621
Oxygen
aerobic and anaerobic conditions, mitochondrial activity, barnyard grass, 474
deprivation, recovery from, *Iris pseudacorus*, 1016
effect on purine-catabolizing enzymes, soybean, 452
peroxisomal enzymes, copper-tolerant pea plants, 570

P

Panicum maximum, bundle sheath cells, mechanism of C_4 photosynthesis, 958
Paraquat, kinetic analysis of resistance, *Conyza*, 869
Pathogens, fungal, monoclonal antibodies, glycoprotein antigens, 508
Pea
binding of antilipase to 62 kD protein, 1084
chloroplasts
phosphorylation, photosystem II components, 638
photosynthetic induction, glucose-6-phosphate dehydrogenase, 598
chloroplast surface protein, binding of imported precursor, ribulose-1,5-bisphosphate carboxylase, 780
copper tolerance, peroxisomal active oxygen enzymes, 570
cotyledons, pressure-driven extrusion, 217
development of *alt* mutant, 1089
epicotyls, calcium asymmetry, gravitropism, 542
β-glucan synthase activity, macromolecule biosynthesis, auxin and fusicoccin, 523
β-glucan synthase modulation, calcium, polycations and protease, 131
isozymes of β-*N*-acetylhexosaminidase, 1118
leaf
fructose 2,6-bisphosphate, synthesis and degradation, 13
plastid development during greening, 808, 816
microsomal cytochrome b_5, characterization, 457
root, uptake and accumulation, herbicides, 82
seed
indirect ELISA development, abscisic acid, 46
water binding, 224
Peanut
binding of antilipase to 62 kD protein, 1084
seed, water binding, 224
Peanut peroxidase, cationic, monoclonal antibodies, 299
Pear
auxin-starved, protein synthesis, quiescence and senescence, 400
inhibition of fruit ripening, mannose, 56
Pepper, source photosynthesis, effect of altered sink:source ratio, 786
Peroxidase, effect of *Pseudomonas putida* colonization, root surface, bean, 537
pH
elicitor-treated bean, ^{31}P NMR study, 716
intracellular, cotton fruit development, NMR spectroscopy, 588
proton cotransport and membrane potential, permanent weak acids, *Lemna gibba*, 674
sodium dioxide fluxes, mesophyll resistances, barley leaves, 922
Phalaris tuberosa, bundle sheath cells, mechanism of C_4 photosynthesis, 958
Pharbitis nil (*see* Morning glory)
Phaseolus vulgaris (*see* Bean)
Phenylalanine ammonia-lyase, 4-coumarate and, mRNA induction in potato, *Phytophthora infestans*, 34
N-Phenylimide S-23142, wavelength effect, cucumber seedlings, 1146
Phosphate
inorganic, inhibited pear fruit ripening, mannose, 56
proton cotransport, membrane potential, *Lemna gibba*, 674
Phosphatidylinositol
breakdown, phytoalexin production, carrot cells, 601
phospholipase C, plant stems, 1151
Phosphoenolpyruvate carboxykinase, C_4 acid decarboxylases and photosynthesis, corn, *Urochloa panicoides* and *Atriplex spongiosa*, 952
Phosphoenolpyruvate carboxylase
C_3 and C_4 plants
comparative studies, 947
nitrogen use efficiency, 355
photocontrol, sorghum leaf, 243
temperature effects, *Crassula argentea* and corn, 497
Phospholipase C, phosphatidylinositol-specific, plant stems, 1151
Phospholipids
breakdown, molecular species specificity, senescing carnation flowers, 679
CHAPS solubilization and functional reconstitution, β-glucan synthase, red beet root, 516
membrane deterioration, senescing carnation flowers, 204
phosphatidylinositol breakdown, phytoalexin production, carrot cells, 601
regulation, UDP-glucose sterol β-D-glucosyl transferase, corn, 51
Phosphorus
concentrations in leaflets, *Lupinus luteus*, 331
mycorrhiza and photosynthesis, soybean plants, 120
phytic acid accumulation, timing and rate, developing soybean seeds, 841
-stressed alfalfa seedling, organic acid exudates, 315
Phosphorylation, photosystem II components, spinach and pea chloroplasts, 638
Photosynthesis
C_4
acid decarboxylases, corn, 952
mechanism, 958
carbon dioxide and light responses, water deficit and recovery, cowpea and pigeonpea, 990
carbon metabolism, light intensity, cucumber, 592
characteristics of C_3-C_4 intermediate, *Parthenium hysterophorus*, 978
electron transport chain, functional size, spinach, 158
Flaveria brownii A.M. Powell, 1063
fluorescence quenching, crassulacean acid metabolism, *Kalanchoë daigremontiana*, 1000
gas exchange, grain filling, wheat flag leaf blades and sheaths, 667
induction, glucose-6-phosphate dehydrogenase activity, pea chloroplasts, 598
metabolism of source leaves, effect of altered sink:source ratio, 786
modulation of water stress effects, potassium, wheat leaf, 655
mycorrhiza, N- and P-fertilized soybean plants, 120
photon flux density, carboxylation efficiency, spinach/soybean/*Arbutus unedo*, 109
sodium requirement, dinitrogen fixation, cyanobacteria, 585
water stress effects, symplast volume, wheat, 1040
Photosystem II
inactivation of *psbA* gene family, cyanobacterium *Synechocystis* 6803, 1021
light/dark changes, *Dunaliella salina*, 194
Phototropism
fluence-response relationships, light- and dark-grown buckwheat, 689
hypocotyls of radish, 379
Phycobilisome, rod linker polypeptides, immunological conservation, 322
Phytic acid, timing and rate of accumulation, developing soybean seeds, 841

Phytoalexin
elicitation of production, phosphatidylinositol breakdown, carrot cells, 601
elicitor-treated bean, ^{31}P NMR study, 716
Phytochelatin, synthesis and glutathione levels, response to heavy metals, tomato cells, 1031
Phytochrome
assimilate partitioning under field conditions, far-red light reflection, green soybean leaves, 350
effect of light and, 1-aminocyclopropane-1-carboxylic acid metabolism, wheat seedling leaves, 643
phosphoenolpyruvate carboxylase, sorghum leaves, 243
regulation, exogenous gibberellins, cowpea epicotyls, 212
Phytohormones
indole-3-acetic acid and abscisic acid, simultaneous quantitation, apple/prune/pear, 419
sexual organogeneses, auxin levels, *Mercurialis annua*, 393
Phytophthora infestans, mRNA induction, potato, 34
Phytophthora megasperma, monoclonal antibodies, glycoprotein antigens, 508
Phytophthora parasitica, proteinaceous elicitors, stress metabolite accumulation, tobacco callus, 733
Pigeonpea, gas exchange, water stress and recovery, 990
Pine, biochemistry of oleoresinosis, 1123
Pinus contorta (*see* Pine)
Pisum sativum (*see* Pea)
Plasmalemma, vesicles of cotton and radish, generation of membrane potential, electron transport, 872
Plasma membrane
calcium transport in sealed vesicles, red beet storage tissue, 1137
H^+-ATPase, aqueous phase partitioning, oat, 693
75 kilodalton protein group, tomato, 1048
presence of polyphosphoinositides, fusogenic carrot cells, 389
Plastids, development during greening, pea leaf, 808, 816
Pollen, corn, isolation, viable sperm cells, 876
Pollination, genotype-dependent leaf senescence, maize, 720
Polyamine oxidase, purification and properties, water hyacinth, 906
Polycations, β-glucan synthase modulation, pea, 131
Polyethylene glycol, induced water stress, salt tolerance and resistance, orange, 430
Polygalacturonase, gene expression, ripening-impaired mutants, tomato, 502
Polygalacturonase-inhibiting protein, purification and characterization, bean, 631
Polypeptides, rod linker, phycobilisome, immunological conservation, 322
Polyphosphoinositides, presence in plasma membranes, fusogenic carrot cells, 389
Polysomes, low temperature, winter rye seedlings, 648
Portulacaria afra, physiological changes, summer drought and rewatering, 481
Potassium
alteration in wheat leaf, modulation of water stress, photosynthesis, 655
role in maintaining growth, sodium chloride and calcium chloride, orange, 434
Potassium channel, properties, *Asclepias tuberosa* protoplasts, 413
Potato, leaf, mRNA induction, *Phytophthora infestans*, 34
Proglobulin, processing enzyme in vacuoles, developing pumpkin cotyledons, 440
Protease, β-glucan synthase modulation, pea, 131
Protein
cell wall, low water potential, soybean, 261
densitometry of nanogram quantities, one-dimensional microslab gels, 1059
heat shock, thermoadaptation, cowpea cells, 4
lipase transfer, barley aleurone cells, 487
pathogenesis-related, full-length cDNAs, tobacco, 942
plasma membrane, tomato, 1048
rod linker, phycobilisome, immunological conservation, 322
synthesis
quiescence and senescence, auxin-starved pear cells, 400
during rehydration, rapidly dried *Tortula ruralis*, 1094
Protein kinase C, phosphatidylinositol breakdown, phytoalexin production, carrot cells, 601
Proton pump, glucose transport, tonoplast membrane, corn, 996
Protons
contransport and membrane potential, permanent weak acids, *Lemna gibba*, 674
effects of temperature on secretion and uptake, excised flexor cells, *Samanea* leaflets, 850
osmotically-induced extrusion, carrot cells, 383
Protoplasts
Asclepias tuberosa, single potassium and chloride channels, 413
corn pollen grains, isolation, viable sperm cells, 876
tobacco, regulation, ribulose bisphosphate carboxylase, 66
Prune, simultaneous quantitation, indole-3-acetic acid, abscisic acid, 419
Pseudoanabaena, nitrogenase genes, continuous organization, 26
Pseudomonas putida, effect of colonization, root surface peroxidase, bean, 537
Pumpkin, developing cotyledons, proglobulin processing enzyme, vacuoles, 440
Purine, catbolizing enzymes, effect of oxygen, soybean, 452
Purothionin, reduction, thioredoxin system, wheat seed, 446
Pyrus communis (*see* Pear)
Pyruvate
dihydrodipicolinate synthase, purification and characterization, wheat, 145
metabolism, NMR spectroscopy, corn, 463

R

Radiation, functional size, photosynthetic electron transport chain, spinach, 158
Radish
phototropism in hypocotyls, 379
plasmalemma-enriched vesicles, generation of membrane potential, electron transport, 872
source photosynthesis, effect of altered sink:source ratio, 786
Rapeseed
binding of antilipase to 62 kD protein, 1084
identification, endogenous gibberellins, 605
induction of freezing tolerance, alteration, gene expression, 699
Raphanusanins, phototropism, hypocotyls of radish, 379
Raphanus sativus (*see* Radish)
Red beet, storage tissue, calcium transport, 1129, 1137
Reductase, light induced polarity, *Elodea canadensis* leaves, 239
Rehydration, protein synthesis, rapidly dried *Tortula ruralis*, 1094
Rhizobium leguminosarum, superior nodulation competitiveness, trifolitoxin, clover, 335
Rhizosphere, phosphorus-stressed alfalfa seedling, exudates, 315
Ribonucleic acid
altered gene expression, freezing tolerance induction, rapeseed, 699
messenger
induction in potato, *Phytophthora infestans*, 34
phosphoenolpyruvate carboxylase, sorghum leaves, 243
polygalacturonase gene expression, tomato, 502
plastid development during greening, pea leaf, 816
polysomes, low temperature, winter rye seedlings, 648
synthesis inhibitors, transcription, maize mitochondria, 304
Ribonucleotide reductase, purothionin reduction, thioredoxin system, wheat seed, 446
Ribosome-inactivating protein, use of cytotoxic plant lectins, review, cancer therapy, 1
Ribulose bisphosphate carboxylase, glyphosate effects, carbon assimilation, sugar beet leaves, 370
Ribulose-1,5-bisphosphate carboxylase
binding of imported precursor, chloroplast surface protein, pea, 780
regulation of gene expression, *Amaranthus hypochondriacus*, 167
Ribulosebisphosphate carboxylase/oxygenase (*see* Rubisco)
Rice
carbon isotope ratios, carbon flux, C_4 host to C_3 parasite, 1143
phosphoenolpyruvate carboxylase, comparative studies, 947
Ricin, use in cancer therapy, 1
Ricinus communis (*see* Castor bean)
Ripening
banana, 277
pear fruit, inhibition, mannose, 56
RNA (*see* Ribonucleic acid)
Root
alfalfa, nonphotosynthetic carbon dioxide fixation, 283
alfalfa seedling, phosphorus-stressed, exudates, 315
Amaranthus hypochondriacus, ribulose 1, 5-bisphosphate carboxylase regulation, 167
bean
superoxide radical, extracellular ferric reduction, 310

surface peroxidase, *Pseudomonas putida* colonization, 537
beet, CHAPS solubilization, β-glucan synthesis, 516
clover, nodulation competitiveness, trifolitoxin production, 335
corn
abscisic acid quantification, 8
damage from lack of support, transfer between solutions, 164
ester and free indol-3yl-acetic acid, growth, 42
extracellular cadmium, compartmental efflux analysis, 62
salt stress, nucleotide metabolism, 984
grass, extracellular cadmium, compartmental efflux analysis, 62
pea, uptake and accumulation, herbicides, 82
soybean, effect of oxygen, purine-catabolizing enzymes, 452
Xanthium strumarium, abscisic acid biosynthesis, 726
Rubisco
nitrogen use efficiency, C_3 and C_4 plants, 355
regulation, tobacco protoplasts, 66
sink removal, leaf senescence, soybean, 662
Rubisco activase, ATP-dependent activation, ribulose bisphosphate carboxylase, spinach, 152

S

Salinity, effect on leaf gas exchange, C_4 nonhalophyte, 1055
Salt
abscisic acid-stimulated osmotic adjustment, adaptation, tobacco, 174
sodium chloride and calcium chloride concentrations, potassium in growth maintenance, orange, 434
stressed corn root tips, nucleotide metabolism, 984
tolerance and resistance, induced water stress, orange, 430
Samanea saman, leaflets, temperature effects, proton secretion and uptake, 850
Secale cereale (*see* Winter rye)
Seed
legume, water binding, 224
Matteuccia struthiopteris, globulin storage proteins, spore germination, 343
Oenothera biennis, photoinduced germination, 879, 885
pea
indirect ELISA development, abscisic acid, 46
isozymes of β-*N*-acetylhexosaminidase, 1118
soybean, development, phytic acid accumulation, 841
wheat, purothionin reduction, thioredoxin system, 446
Seedling
alfalfa, phosphorus-stressed, organic acid exudates, 315
barley, light-harvesting chlorophyll protein biosynthesis, 971
barnyard grass, mitochondrial activity, aerobic and anaerobic conditions, 474
corn
light-harvesting chlorophyll protein biosynthesis, 971
thermotolerance, heat shock proteins, 575
cucumber, wavelength effect, diphenylether-type herbicidal action, 1146
Mung bean, L-*myo*-inositol-1-phosphate synthase, chloroplast, 611
pea, light-harvesting chlorophyll protein biosynthesis, 971
soybean, light-harvesting chlorophyll protein biosynthesis, 971
wheat
BASF 13.338 treatment, cation-induced changes, 17
effect of light and phytochrome, 1-aminocyclopropane-1-carboxylic acid metabolism, 643
winter rye, polysomes, low temperature, 648
Senescence
carnation flower
membrane deterioration, 204
phospholipid breakdown, molecular species specificity, 679
genotype-dependent, maize leaf, 720
protein synthesis, auxin-starved pear cells, 400
soybean leaf, sink removal, 662
wheat flag leaf blades and sheaths, gas exchange patterns, 667
Sesquiterpenoid, induction of biosynthesis, fungal elicitor, tobacco, 469
Sexual organogeneses, master regulatory genes, auxin levels, *Mercurialis annua*, 393
Shoot
morning glory, inversion inhibition, stem elongation, 104
rapeseed, identification, endogenous gibberellins, 605
Sink, altered sink:source ratio, photosynthetic metabolism, various plants, 786
Sodium
Na^+/H^+ antiport activity, amiloride analogs, sugar beet tonoplast, 30
requirement for photosynthesis, dinitrogen fixation, cyanobacteria, 585
Sodium chloride
adaptation, abscisic acid-stimulated adjustment, tobacco, 174
role of potassium, growth maintenance, orange, 434
Sodium dioxide, flux into leaf cells, cellular acidification, barley leaves, 928
Solanum melongena (*see* Eggplant)
Solutes, measurement errors, unsupported roots, corn, 164
Sorghum
Hill reaction, hydrogen peroxide scavenging, ascorbate peroxidase, 294
leaf
fructose 2,6-bisphosphate, synthesis and degradation, 13
photocontrol, phosphoenolpyruvate carboxylase, 243
Sorghum bicolor
carbon isotope ratios, carbon flux, C_4 host to C_3 parasite, 1143
genetic regulation of development, 615
Sorghum sudanense, bundle sheath cells, mechanism of C_4 photosynthesis, 958
Sorghum vulgare (*see* Sorghum)
Soybean
binding of antilipase to 62 kD protein, 1084
carbohydrate supply, dinitrogen fixation, varied daylength and stem girdling, 137
cell wall proteins, low water potentials, 261
effect of nitrate, organic acid and amino acid composition, 774
effect of oxygen, purine-catabolizing enzymes, 452
leaf
far-red light reflection, assimilate partitioning, 350
nitric oxide emissions, 96
traits, flavonol glycoside genes, 20
leaf development, metabolism, sucrose synthase and invertase, 407
nodule
metabolite concentrations, bacteroids and cytosol, 768
mycorrhiza effects, transpiration, 115
mycorrhiza, photosynthesis, 120
ovaries, setting and aborting, free amino acid content, 91
phosphatidylinositol-specific phospholipase C, 1151
photosynthetic photon flux density, carboxylation efficiency, 109
seed
development, phytic acid accumulation, 841
water binding, 224
sink removal, leaf senescence, 662
water binding, desiccation tolerance, 232
Sperm cells, viability, isolation, corn pollen grains, 876
Spinach
ammonia assimilation, glutamate transport, presence of dicarboxylates, 621
chloroplasts, phosphorylation, photosystem II components, 638
functional size, photosynthetic electron transport chain, 158
leaf
chloroplasts, fatty acid hydroperoxide metabolism, 1073
fructose 2,6-bisphosphate, synthesis and degradation, 13
gibberellin oxidases, partial purification, 87
subunit structure, ADPglucose pyrophosphorylase, 182
photosynthetic photon flux density, carboxylation efficiency, 109
rubisco activase, ATP-dependent activation, ribulose bisphosphate carboxylase, 152
Spinacia oleracea (*see* Spinach)
Spores, germination, globulin storage proteins, *Matteuccia struthiopteris*, 343
Squash
5′-azido-*N*-1-napthylphthalamic acid, synthesis, binding properties, 22
purified NAD(P)H dehydrogenase, 828
Starch
intracellular carbon partitioning, *Chlamydomonas reinhardtii*, 892
localization of metabolizing enzyme, *Commelina communis* guard cells, 360
Stem
Amaranthus hypochondriacus, ribulose 1, 5-bisphosphate carboxylase regulation, 167
bean, phosphatidylinositol-specific phospholipase C, 1151
morning glory, elongation, shoot inversion inhibition, 104
soybean

carbohydrate supply, dinitrogen fixation, 137
phosphatidylinositol-specific phospholipase C, 1151
Sterols, UDP-glucose sterol β-D-glucosyl transferase, regulation by phospholipids, corn, 51
Stomata
acid-induced opening, guard cell wall elasticity, broad bean, 554
promotion of opening, indoleacetic acid and ethrel, broad bean, 318
Stress metabolites, accumulation in tobacco callus, proteinaceous elicitors, *Phytophtora parasitica*, 733
Succinate, exudates, phosphorus-stressed alfalfa seedling, 315
Sucrose
carbohydrate metabolism, leaf growth, fescue, 548
freezing tolerance induction, altered gene expression, rapeseed, 699
fructan synthesis, enzymology, barley, 706
influence of mannose, apoplasmic retrieval systems, beet and tobacco, 423
synthase and invertase, metabolism, development of soybean and beet leaves, 407
Sucrose analog, transport and metabolism, no invertase hydrolysis, corn endosperm, 902
Sucrose phosphate, photosynthetic carbon metabolism, light intensity, cucumber, 592
Sugar, assimilate unloading, maize pedicel tissues, 558
Sulfometuron methyl, resistance, mutations in *Chlamydomonas reinhardtii*, 898
Sulfur, elemental, metabolization in wheat leaves, foliar application, 1026
Sulfur dioxide, fluxes, mesophyll resistances, barley leaves, 922
Sunflower, binding of antilipase to 62 kD protein, 1084
Superoxide dismutase, recovery from oxygen deprivation, *Iris pseudacorus*, 1016
Superoxide radical, extracellular ferric reduction, iron-deficient bean roots, 310
Surfactants, octylphenoxy, sorption of triton X-100, tomato cuticles, 965
Synechococcus, carbonic anhydrase, inorganic carbon uptake, 72

T

Tabtoxinine-β-lactam, transport into cultured corn cells, 845
Temperature
effects on phosphoenolpyruvate carboxylase, *Crassula argentea* and corn, 497
effects on proton secretion and uptake, excised flexor cells, *Samanea* leaflets, 850
foliage, water deficit and glutathione reductase, winter wheat, 100
Knudsen-transitional flow, gas pressurization, *Nelumbo* leaves, 199
low, polysomes, winter rye, 648
Thaumatin, characterization of osmotin, tobacco, 529
Thaw, ice encasement injury, microsomal membranes, winter wheat crowns, 1068
Thermoadaptation, heat shock proteins, cowpea cells, 4
Thermotolerance, heat shock proteins, maize, 575
Thiamine, development of *alt* mutant, pea, 1089
Thioredoxin, system in wheat seed, reduction of purothionin, 446
Threonine, acetate and pyruvate metabolism, NMR spectroscopy, corn, 463
Thylakoid membranes
BASF 13.338-treated, cation-induced changes, wheat seedlings, 17
spinach and pea, phosphorylation, photosystem II components, 638
Tobacco
abscisic acid-stimulated osmotic adjustment, sodium chloride adjustment, 174
characterization of osmotin, 529
full-length cDNAs, pathogenesis-related proteins, 942
induction of sesquiterpenoid biosynthesis, fungal elicitor, 469
leaf, influence of mannose, apoplasmic retrieval systems, 423
p-fluorophenylalanine resistant and wild-type, subcellular localization, amines, 78
phosphoenolpyruvate carboxylase, comparative studies, 947
proteinaceous elicitor from *Phytophthora parasitica*, 733
protoplasts, regulation, ribulose bisphosphate carboxylase, 66
resistance to lepidopteran insects, *Bacillus thuringiensis* δ-endotoxin, 1103
Tomato
cuticles, sorption of triton X-100, octylphenoxy surfactants, 965
galactose-stimulated ethylene production, 804
leaf, characteristics, glutamate synthases, 1036
plasma membrane proteins, 1048
polygalacturonase gene expression, 502
response to heavy metals, phytochelatin synthesis, glutathione levels, 1031
Tonoplast vesicles
corn, glucose transport, proton pumping, 996
phloem segments of celery, glucose, facilitated transport, 711
red beet vacuoles, ionic leak effect, microelectrode measurement, 608
sugar beet, inhibited Na^+/H^+ antiport activity, amiloride analogs, 30
Tortula ruralis, rapidly dried, protein synthesis, rehydration, 1094
Toxins, use of cytotoxic plant lectins, review, cancer therapy, 1
Transpiration, effects of mycorrhiza on nodule activity, drought stress, soybeans, 115
Trifolitoxin, production and nodulation, *Rhizobium leguminosarum* competitiveness, clover, 335
Trimethylacetic acid, membrane potential, proton cotransport, *Lemna gibba*, 674
Triticum vulgare (*see* Wheat)
Tyrosine decarboxylase, subcellular localization of amines, *p*-fluorophenylalanine, tobacco, 78

U

UDP-glucose, inhibition, UDP-pyridoxal, mung bean, 1008
UDP-glucose sterol β-D-glucosyl transferase, regulation by phospholipids, kinetic studies, corn, 51
Ureides, effect of oxygen, purine-catabolizing enzymes, soybean, 452
Uridine, metabolism, salt-stressed corn root tips, 984
Urochloa panicoides
bundle sheath cells, mechanism of C_4 photosynthesis, 958
C_4 acid decarboxylases and photosynthesis, 952

V

Vacuoles
proglobulin processing enzyme, developing pumpkin cotyledons, 440
red beet, microelectrode measurements, ionic leak effect, 608
Valine, acetate and pyruvate metabolism, NMR spectroscopy, corn, 463
Vicia faba (*see* Broad bean)
Vigna radiata (*see* Mung bean)
Vindoline, indole alkaloid biosynthesis, compartmentation, *Catharanthus roseus*, 1099
Vitamin C, vitamin E and somatic embryo development, antioxidants, wild carrot, 273

W

Water
binding
desiccation tolerance and, soybean and ferns, 232
legume seeds, 224
imbibition, pressure-driven extrusion, bean and pea cotyledons, 217
Water hyacinth, polyamine oxidase, purification, properties, 906
Water potential, low, cell wall proteins, soybean, 261
Water stress
bean leaves, xanthophylls, abscisic acid biosynthesis, 910
effects of mycorrhiza on nodule activity, transpiration, soybeans, 115
effects on photosynthesis, symplast volume, wheat, 1040
foliage temperature effect, glutathione reductase, winter wheat, 100
modulation, photosynthesis, altered wheat leaf potassium, 655
physiological changes, *Portulacaria afra*, 481
polyethylene glycol-induced, salt tolerance and resistance, orange, 430
recovery and, gas exchange, cowpea and pigeonpea, 990
Weed, seed, ethephon uptake and fate, 155
Wheat
coleoptiles, membrane potentials, diclofop and diclofop-methyl, 188
dihydrodipicolinate synthase, purification, characterization, 145
flag leaves and sheaths, grain filling, photosynthetic gas exchange, 667
leaf
metabolization, elemental sulfur, 1026
modulation of water stress, photosynthesis, 655
phosphoenolpyruvate carboxylase, comparative studies, 947
seed, purothionin reduction, thioredoxin system, 446

seedling, BASF 13.338 treatment, cation-induced changes, 17
seedling leaves, effect of light and phytochrome, 1-aminocyclopropane-1-carboxylic acid metabolism, 643
water stress effects, photosyntheis, 1040
winter, *see* Winter wheat
Winter rye, seedling, polysomes, low temperature, 648
Winter wheat
crowns, ice encasement injury, microsomal membranes, 1068
foliage temperature and water deficit, glutathione reductase, 100

X

Xanthine dehydrogenase, effect of oxygen, purine-catabolizing enzymes, soybean, 452
Xanthium strumarium, leaves and roots, abscisic acid biosynthesis, 726
Xanthophylls, abscisic acid biosynthesis and, water-stressed bean leaves, 910
Xanthoxin, conversion to abscisic acid, cell-free preparations, bean leaves, 916
X-ray microananlysis, phosphorus concentrations, *Lupinus luteus* leaflets, 331

Z

Zucchini, binding of antilipase to 62 kD protein, 1084

Volume Contents

Number 1. September

REVIEW

1 **The Use of Cytotoxic Plant Lectins in Cancer Therapy**—J. Michael Lord

COMMUNICATIONS

4 **Synthesis of Only Two Heat Shock Proteins Is Required for Thermoadaptation in Cultured Cowpea Cells**—Kathleen Heuss-La Rosa, Randall R. Mayer, and Joe H. Cherry*

8 **Quantification of Abscisic Acid in a Single Maize Root**—Philippe Reymond, Martial Saugy, and Paul-Emil Pilet*

10 **Role of Catecholamines in Promotion of Flowering in a Short-Day Duckweed, *Lemna paucicostata* 6746**—J. P. Khurana, B. K. Tamot, N. Maheshwari, and S. C. Maheshwari*

13 **Ion-Exchange Chromatography Separates Activities Synthesizing and Degrading Fructose 2,6-Bisphosphate from C_3 and C_4 Leaves but Not from Rat Liver**—Fraser D. Macdonald, Qun Chou, and Bob B. Buchanan*

17 **Changes in the Cationic Regulation of Structure and Function in Thylakoids Isolated from Wheat Seedlings Treated with BASF 13.338**—Ramasamy Mannar Mannan* and Salil Bose

20 **Leaf Traits Associated with Flavonol Glycoside Genes in Soybean**—B. R. Buttery* and R. I. Buzzell

22 **5′-Azido-*N*-1-Naphthylphthalamic Acid, a Photolabile Analog of *N*-1-Naphthylphthalamic Acid. Synthesis and Binding Properties in *Curcurbita pepo* L.**—Judith G. Voet*, Kathleen S. Howley, and Jed S. Shumsky

26 **Contiguous Organization of Nitrogenase Genes in a Heterocystous Cyanobacterium**—Barry Saville, Neil Straus, and John R. Coleman*

30 **Inhibition of Na^+/H^+ Antiport Activity in Sugar Beet Tonoplast by Analogs of Amiloride**—Eduardo Blumwald*, Edward J. Cragoe, Jr., and Ronald J. Poole

ARTICLES

34 **Transient Induction of Phenylalanine Ammonia-Lyase and 4-Coumarate: CoA Ligase mRNAs in Potato Leaves Infected with Virulent or Avirulent Races of *Phytophthora infestans***—Karl-Heinrich Fritzemeier, Claude Crétin, Erich Kombrink, Frauke Rohwer, Janet Taylor, Dierk Scheel, and Klaus Hahlbrock*

42 **Changes in the Level of Free and Ester Indol-3yl-Acetic Acid in Growing Maize Roots**—Martial Saugy and Paul-Emile Pilet*

46 **The Development of an Indirect Enzyme Linked Immunoassay for Abscisic Acid**—Gavin S. Ross*, Peter A. Elder, James A. McWha, David Pearce, and Richard P. Pharis

51 **Regulation by Phospholipids and Kinetic Studies of Plant Membrane-Bound UDP-Glucose Sterol β-D-Glucosyl Transferase**—Pascaline Ullmann, Pierrette Bouvier-Navé*, and P. Benveniste

56 **Inhibition of Pear Fruit Ripening by Mannose**—Christopher B. Watkins and Chaim Frenkel*

62 **Compartmental Efflux Analysis and Removal of Extracellular Cadmium from Roots**—Wilfried E. Rauser

66 **Factors Affecting the Activation State and the Level of Total Activity of Ribulose Bisphosphate Carboxylase in Tobacco Protoplasts**—Michael E. Salvucci* and Joan C. Anderson

72 **Carbonic Anhydrase and the Uptake of Inorganic Carbon by *Synechococcus* sp. (UTEX-2380)**—ChingKuang Tu, Hart Spiller, George C. Wynns, and David N. Silverman*

78 **Subcellular Localization of Amines and Activities of Their Biosynthetic Enzymes in *p*-Fluorophenylalanine Resistant and Wild-Type Tobacco Cell Cultures**—Mark A. Walker*, Brian E. Ellis, Clint C. S. Chapple, and Erwin B. Dumbroff

82 **Uptake and Accumulation of the Herbicides Chlorsulfuron and Clopyralid in Excised Pea Root Tissue**—Malcolm D. Devine*, Hank D. Bestman, and William H. Vanden Born

87 **Partial Purification of Gibberellin Oxidases from Spinach Leaves**—Sarah J. Gilmour, Anthony B. Bleecker, and Jan A. D. Zeevaart*

91 **Free Amino Acid Content and Metabolic Activities of Setting and Aborting Soybean Ovaries**—H. Ghiasi, Christian Paech*, and C. Dean Dybing

96 **Nitric Oxide Emissions from Soybean Leaves during *in Vivo* Nitrate Reductase Assays**—Lowell A. Klepper

100 **Plant Morphological and Biochemical Responses to Field Water Deficits. III. Effect of Foliage Temperature on the Potential Activity of Glutathione Reductase**—John J. Burke* and Jerry L. Hatfield

104 **Shoot Inversion Inhibition of Stem Elongation in *Pharbitis nil*. A Possible Role for Ethylene-Induced Glycoprotein and Lignin**—Tottempudi K. Prasad and Morris G. Cline*

109 **Effect of Photosynthetic Photon Flux Density on Carboxylation Efficiency**—James A. Weber*, John D. Tenhunen, David M. Gates, and Otto L. Lange

115 ***Glycine-Glomus-Rhizobium* Symbiosis. V. Effects of Mycorrhiza on Nodule Activity and Transpiration in Soybeans under Drought Stress**—Gabor J. Bethlenfalvay*, Milford S. Brown, Keiko L. Mihara, and Alan E. Stafford

120 ***Glycine-Glomus-Rhizobium* Symbiosis. VI. Photosynthesis in Nodulated, Mycorrhizal, or N- and P-Fertilized Soybean Plants**—Milford S. Brown and Gabor J. Bethlenfalvay*

124 **Light and Acetate Regulate a Mitochondrial Malate Dehydrogenase**—Friedhelm Struck, Sabine Grölz-Krug, Bruce Boschek, and Klaus Zetsche*

131 **Modulation of Pea Membrane β-Glucan Synthase Activity by Calcium, Polycation, Endogenous Protease, and Protease Inhibitor**—Vincent Girard and Gordon Maclachlan*

137 **Carbohydrate Supply and N_2 Fixation in Soybean. The Effect of Varied Daylength and Stem Girdling**—Kerry B. Walsh*, J. Kevin Vessey, and David B. Layzell

145 **Purification and Characterization of Dihydrodipicolinate Synthase from Wheat Suspension Cultures**—Rosarin Kumpaisal, Takashi Hashimoto, and Yasuyuki Yamada*

* Author to whom correspondence should be addressed.

Continued on next page

152 **Rubisco Activase Mediates ATP-Dependent Activation of Ribulose Bisphosphate Carboxylase**—V. J. Streusand and Archie R. Portis, Jr.*

155 **Uptake and Fate of Ethephon ([2-Chloroethyl]phosphonic Acid) in Dormant Weed Seeds**—J. Stephen Goudey, Hargurdeep S. Saini, and Mary S. Spencer*

158 **Functional Size of Photosynthetic Electron Transport Chain Determined by Radiation Inactivation**—Run Sun Pan, Lee Feng Chien, May Yun Wang, Mai Yu Tsai, Rong Long Pan*, and Ban Dar Hsu

164 **Errors in the Measurement of Root Pressure and Exudation Volume Flow Rate Caused by Damage during the Transfer of Unsupported Roots between Solutions**—David M. Miller

167 **Coordinate, Organ-Specific and Developmental Regulation of Ribulose 1,5-Bisphosphate Carboxylase Gene Expression in *Amaranthus hypochondriacus***—Basil J. Nikolau and Daniel F. Klessig*

174 **Abscisic Acid Stimulated Osmotic Adjustment and Its Involvement in Adaptation of Tobacco Cells to NaCl**—P. Christopher LaRosa, Paul M. Hasegawa, David Rhodes, Jean M. Clithero, Abd-Elrahem A. Watad, and Ray A. Bressan*

182 **Subunit Structure of Spinach Leaf ADPglucose Pyrophosphorylase**—Matthew K. Morell, Mark Bloom, Vicki Knowles, and Jack Preiss*

188 **Effects of Diclofop and Diclofop-Methyl on the Membrane Potentials of Wheat and Oat Coleoptiles**—John P. Wright and Richard H. Shimabukuro

194 **Dynamics of Photosystem II and Its Light Harvesting System in Response to Light Changes in the Halotolerant Alga *Dunaliella salina***—Uri Pick, Kleoniki Gounaris, and James Barber

199 **Knudsen-Transitional Flow and Gas Pressurization in Leaves of *Nelumbo***—John W. H. Dacey

204 **Membrane Deterioration in Senescing Carnation Flowers. Coordinated Effects of Phospholipid Degradation and the Action of Membranous Lipoxygenase**—Maribeth Fobel, Daniel V. Lynch, and John E. Thompson*

212 **Phytochrome Regulation of the Response to Exogenous Gibberellins by Epicotyls of *Vigna sinensis***—José L. García-Martínez, Brian Keith, Bruce A. Bonner, Allan E. Stafford, and Lawrence Rappaport*

217 **Pressure-Driven Extrusion of Intracellular Substances from Bean and Pea Cotyledons during Imbibition**—Stephen C. Spaeth

224 **Water Binding in Legume Seeds**—Christina W. Vertucci* and A. Carl Leopold

232 **The Relationship between Water Binding and Desiccation Tolerance in Tissues**—Christina W. Vertucci* and A. Carl Leopold

239 **Light Induced Polarity of Redox Reactions in Leaves of *Elodea canadensis* Michx**—J. Theo M. Elzenga* and Hidde B. A. Prins

243 **Photocontrol of Sorghum Leaf Phosphoenolpyruvate Carboxylase. Characterization of Messenger RNA and of Photoreceptor**—Martine Thomas*, Claude Crétin, Eliane Keryer, Jean Vidal, and Pierre Gadal

247 **Mass-Action Expressions of Ion Exchange Applied to Ca^{2+}, H^+, K^+, and Mg^{2+} Sorption on Isolated Cell Walls of Leaves from *Brassica oleracea***—Douglas Scott Bush* and John G. McColl

261 **Cell Wall Proteins at Low Water Potentials**—Connie S. Bozarth, John E. Mullet, and John S. Boyer*

268 **Actin of *Chara* Giant Internodal Cells. A Single Isoform in the Subcortical Filament Bundles and a Larger, Immunologically Related Protein in the Chloroplasts**—Richard E. Williamson*, David W. McCurdy, Ursula A. Hurley, and Jean L. Perkin

273 **Control of Wild Carrot Somatic Embryo Development by Antioxidants. A Probable Mode of Action of 2,4-Dichlorophenoxyacetic Acid**—Brent A. Earnshaw and Morris A. Johnson*

277 **Banana Ripening: Implications of Changes in Internal Ethylene and CO_2 Concentrations, Pulp Fructose 2,6-Bisphosphate Concentration, and Activity of Some Glycolytic Enzymes**—Randolph M. Beaudry, Nachman Paz, Clanton C. Black, and Stanley J. Kays*

283 **Nonphotosynthetic CO_2 Fixation by Alfalfa (*Medicago sativa* L.) Roots and Nodules**—Michael P. Anderson, Gary H. Heichel*, and Carroll P. Vance

290 **Assessment of Spatial Distribution of Growth in the Elongation Zone of Grass Leaf Blades**—Hans Schnyder, Curtis J. Nelson*, and John H. Coutts

294 **Hill Reaction, Hydrogen Peroxide Scavenging, and Ascorbate Peroxidase Activity of Mesophyll and Bundle Sheath Chloroplasts of NADP-Malic Enzyme Type C_4 Species**—Yoshiyuki Nakano and Gerald E. Edwards*

299 **Production and Preliminary Characterization of Monoclonal Antibodies against Cationic Peanut Peroxidase**—Chunfang Hu*, Daniela Carboner, and Robert van Huystee

304 ***In Organello* Transcription in Maize Mitochondria and Its Sensitivity to Inhibitors of RNA Synthesis**—Patrick M. Finnegan and Gregory G. Brown*

310 **Involvement of Superoxide Radical in Extracellular Ferric Reduction by Iron-Deficient Bean Roots**—Ismail Cakmak, Dirk A. M. van de Wetering, Horst Marschner, and H. Frits Bienfait*

Number 2. October

COMMUNICATIONS

315 **Citrate, Malate, and Succinate Concentration in Exudates from P-Sufficient and P-Stressed *Medicago sativa* L. Seedlings**—Doug S. Lipton, Robert W. Blanchar, and Dale G. Blevins*

318 **Promotion of Stomatal Opening by Indoleacetic Acid and Ethrel in Epidermal Strips of *Vicia faba* L.**—Linda K. Levitt, Diana B. Stein*, and Bernard Rubinstein

322 **Immunological Conservation of Phycobilisome Rod Linker Polypeptides**—Barbara A. Zilinskas* and Dawn A. Howell

327 **Construction and Homologous Expression of a Maize *Adh1* Based *Nco*I Cassette Vector**—Lisa Lee, Carmen Fenoll, and Jeffrey L. Bennetzen*

331 **Quantitative Estimates of Phosphorus Concentrations within *Lupinus luteus* Leaflets by Means of Electron Probe X-ray Microanalysis**—Michael T. Treeby*, Reinhard F. M. Van Steveninck, and Hilde M. De Vries

ARTICLES

335 **Trifolitoxin Production and Nodulation Are Necessary for the Expression of Superior Nodulation Competitiveness by *Rhizobium leguminosarum* bv. *trifolii***

Strain T24 on Clover—Eric W. Triplett* and Terese M. Barta

343 **Biochemistry of Fern Spore Germination: Globulin Storage Proteins in *Matteuccia struthiopteris* L.**—Thomas S. Templeman, Augustus E. DeMaggio*, and David A. Stetler

350 **Far-Red Light Reflection from Green Leaves and Effects on Phytochrome-Mediated Assimilate Partitioning under Field Conditions**—Michael J. Kasperbauer

355 **The Nitrogen Use Efficiency of C_3 and C_4 Plants. III. Leaf Nitrogen Effects on the Activity of Carboxylating Enzymes in *Chenopodium album* (L.) and *Amaranthus retroflexus* (L.)**—Rowan F. Sage*, Robert W. Pearcy, and Jeffrey R. Seemann

360 **Localization of Carbohydrate Metabolizing Enzymes in Guard Cells of *Commelina communis***—Nina L. Robinson and Jack Preiss*

365 **Glyphosate Effects on Carbon Assimilation and Gas Exchange in Sugar Beet Leaves**—Donald R. Geiger*, Michelle A. Tucci, and Jerome C. Servaites

370 **Glyphosate Effects on Carbon Assimilation, Ribulose Bisphosphate Carboxylase Activity, and Metabolite Levels in Sugar Beet Leaves**—Jerome C. Servaites, Michelle A. Tucci, and Donald R. Geiger*

375 **Characterization of Nitrate Reductases from Corn Leaves (*Zea mays* cv W64AxW182E) and *Chlorella vulgaris*. Sensitivity to a Proteinase Extracted from Corn Roots**—M. Poulle, Ann Oaks*, P. Bzonek, V. J. Goodfellow, and L. P. Solomonson

379 **Phototropism in Hypocotyls of Radish. IV. Flank Growth and Lateral Distribution of *cis*- and *trans*-Raphanusanins in the First Positive Phototropic Curvature**—Koji Hasegawa*, Hisashi Noguchi, Chikako Tanoue, Seiji Sando, Mitsuo Takada, Masako Sakoda, and Tohru Hashimoto

383 **Osmotically Induced Proton Extrusion from Carrot Cells in Suspension Culture**—Moshe Reuveni*, Roberta Colombo, Henri R. Lerner, Alain Pradet, and Alexandra Poljakoff-Mayber

389 **Polyphosphoinositides Are Present in Plasma Membranes Isolated from Fusogenic Carrot Cells**—Jeffery J. Wheeler and Wendy F. Boss*

393 **Master Regulatory Genes, Auxin Leaves, and Sexual Organogeneses in the Dioecious Plant *Mercurialis annua***—Saïd Hamdi*, Gerard Teller, and Jean-Paul Louis

400 **Protein Synthesis Associated with Quiescence and Senescence in Auxin-Starved Pear Cells**—Jean-Marc Lelievre*, Claudine Balague, Jean-Claude Pech, and Yves Meyer

407 **Contributions of Sucrose Synthase and Invertase to the Metabolism of Sucrose in Developing Leaves. Estimation by Alternate Substrate Utilization**—J. Gougler Schmalstig and William D. Hitz*

413 **Properties of Single K^+ and Cl^- Channels in *Asclepias tuberosa* Protoplasts**—Charles L. Schauf* and Kathryn J. Wilson

419 **Simultaneous Quantitation of Indole 3-Acetic Acid and Abscisic Acid in Small Samples of Plant Tissue by Gas Chromatography/Mass Spectrometry/Selected Ion Monitoring**—John H. Vine*, Dominique Noiton, Julie A. Plummer, Cristina Baleriola-Lucas, and Michael G. Mullins

423 **Influence of Mannose on the Apoplasmic Retrieval Systems of Source Leaves**—William J. Lucas* and Clyde Wilson

430 **Relationship between Salt Tolerance and Resistance to Polyethylene Glycol-Induced Water Stress in Cultured Citrus Cells**—Gozal Ben-Hayyim

434 **Role of Internal Potassium in Maintaining Growth of Cultured *Citrus* Cells on Increasing NaCl and $CaCl_2$ Concentrations**—Gozal Ben-Hayyim*, Uzi Kafkafi, and Ruth Ganmore-Neumann

440 **Proglobulin Processing Enzyme in Vacuoles Isolated from Developing Pumpkin Cotyledons**—Ikuko Hara-Nishimura* and Mikio Nishimura

446 **Reduction of Purothionin by the Wheat Seed Thioredoxin System**—Thomas C. Johnson, Keishiro Wada, Bob B. Buchanan*, and Arne Holmgren

452 **Appearance of Purine-Catabolizing Enzymes in Fix^+ and Fix^- Root Nodules on Soybean and Effect of Oxygen on the Expression of the Enzymes in Callus Tissue**—Knud Larsen and Bjarne U. Jochimsen*

457 **Purification and Characterization of Microsomal Cytochrome b_5 and NADH Cytochrome b_5 Reductase from *Pisum sativum***—David R. Jollie, Stephen G. Sligar, and Mary Schuler*

463 **Characterization of Acetate and Pyruvate Metabolism in Suspension Cultures of *Zea mays* by ^{13}C NMR Spectroscopy**—Dennis J. Ashworth*, Rino Y. Lee, and Douglas O. Adams

469 **Induction of Sesquiterpenoid Biosynthesis in Tobacco Cell Suspension Cultures by Fungal Elicitor**—Joseph Chappell* and Ross Nable

474 **Activities of Isolated Mitochondria and Mitochondrial Enzymes from Aerobically and Anaerobically Germinated Barnyard Grass (*Echinochloa*) Seedlings**—Robert A. Kennedy*, Theodore C. Fox, and James N. Siedow

481 **Physiological Changes in *Portulacaria afra* (L.) Jacq. during a Summer Drought and Rewatering**—Lonnie J. Guralnick* and Irwin P. Ting

487 **Does Gibberellic Acid Induce the Transfer of Lipase from Protein Bodies to Lipid Bodies in Barley Aleurone Cells?**—Donna E. Fernandez* and L. Andrew Staehelin

497 **Temperature Effects on Phosphoenolpyruvate Carboxylase from a CAM and a C_4 Plant. A Comparative Study**—Min-Xian Wu and Randolph T. Wedding*

502 **Polygalacturonase Gene Expression in Rutgers, *rin*, *nor*, and *Nr* Tomato Fruits**—Dean DellaPenna, David S. Kates, and Alan B. Bennett*

508 **Monoclonal Antibodies to Glycoprotein Antigens of a Fungal Plant Pathogen, *Phytophthora megasperma* f. sp. *glycinea***—Keith L. Wycoff, Jody Jellison, and Arthur R. Ayers*

516 **CHAPS Solubilization and Functional Reconstitution of β-Glucan Synthase from Red Beet Root (*Beta vulgaris* L.) Storage Tissue**—Margaret E. Sloan, Panayotis Rodis, and Bruce P. Wasserman*

523 **Involvement of Macromolecule Biosynthesis in Auxin and Fusicoccin Enhancement of β-Glucan Synthase Activity in Pea**—Peter M. Ray

529 **Characterization of Osmotin. A Thaumatin-Like Protein Associated with Osmotic Adaptation in Plant Cells**—Narendra K. Singh, Charles A. Bracker, Paul M. Hasegawa, Avtar K. Handa, Scott Buckel, Mark A. Hermodson, Ed Pfankoch, Fred E. Regnier, and Ray A. Bressan*

537 **The Effect of *Pseudomonas putida* Colonization on Root Surface Peroxidase**—Frederick Albert and Anne J. Anderson*

542 **On the Nature and Origin of the Calcium Asymmetry Arising during Gravitropic Response in Etiolated**

Pea Epicotyls—Fernando Migliaccio and Arthur W. Galston*

548 **Growth Rates and Carbohydrate Fluxes within the Elongation Zone of Tall Fescue Leaf Blades**—Hans Schnyder and Curtis J. Nelson*

554 **Acid-Induced Stomatal Opening in *Vicia faba* L. and the Role of Guard Cell Wall Elasticity**—Dennis J. Bittisnich*, Lynda O. Entwisle, and Tom F. Neales

558 **Assimilate Unloading from Maize (*Zea mays* L.) Pedicel Tissues. II. Effects of Chemical Agents on Sugar, Amino Acid, and ^{14}C-Assimilate Unloading**—Gregory A. Porter*, Daniel P. Knievel, and Jack C. Shannon

566 **Leaves of the Orchid Twayblade (*Listera ovata*) Contain a Mannose-Specific Lectin**—Els J. M. Van Damme, Anthony K. Allen, and Willy J. Peumans*

570 **Increased Levels of Peroxisomal Active Oxygen-Related Enzymes in Copper-Tolerant Pea Plants**—José M. Palma, Manuel Gómez, Juan Yáñez, and Luis A. Del Río*

575 **Establishment of Thermotolerance in Maize by Exposure to Stresses Other than a Heat Shock Does Not Require Heat Shock Protein Synthesis**—Peta C. Bonham-Smith, Manju Kapoor, and J. Derek Bewley*

581 **Interaction between Green and Far-Red Light on the Low Fluence Rate Chloroplast Orientation in *Mougeotia***—Zbigniew Lechowski* and Jan Białczyk

585 **Sodium Requirement for Photosynthesis and Its Relationship with Dinitrogen Fixation and the External CO_2 Concentration in Cyanobacteria**—Eva Sanchez Maeso, Francisca Fernandez Piñas, Mercedes Garcia Gonzalez, and Eduardo Fernandez Valiente*

588 **Intracellular pH of Cotton Embryos and Seed Coats during Fruit Development Determined by ^{31}P Nuclear Magnetic Resonance Spectroscopy**—Donald L. Hendrix*, John W. Radin, and Ronald A. Nieman

592 **Regulation of Photosynthetic Carbon Metabolism in Cucumber by Light Intensity and Photosynthetic Period**—N. Suzanne Robbins and David M. Pharr*

598 **Changing Activity of Glucose-6-Phosphate Dehydrogenase from Pea Chloroplasts during Photosynthetic Induction**—Xiao-Hua Yuan and Louise E. Anderson*

Number 3. November

COMMUNICATIONS

601 **Breakdown of Phosphatidylinositol during the Elicitation of Phytoalexin Production in Cultured Carrot Cells**—Fumiya Kurosaki*, Yutaka Tsurusawa, and Arasuke Nishi

605 **Identification of Endogenous Gibberellins from Oilseed Rape**—Stewart B. Rood*, David Pearce, and Richard P. Pharis

608 **Microelectrode Measurements on Red Beet Vacuole. Biological Effect of Na^+ or NO_3^- Ions, Diffusing from the Microelectrode**—Jean-Paul Lassalles*, Joël Alexandre, and Michel Thellier

611 **Chloroplast as a Locale of L-*myo*-Inositol-1-Phosphate Synthase**—Jukta Adhikari, Asima Lahiri Majumder, Tirtha Jyoti Bhaduri, Sarmila DasGupta, and Arun Lahiri Majumder*

615 **Genetic Regulation of Development in *Sorghum bicolor*. IV. GA_3 Hastens Floral Differentiation but Not Floral Development under Nonfavorable Photoperiods**—Page W. Morgan* and J. Roy Quinby

ARTICLES

621 **^{15}N-Ammonia Assimilation, 2-Oxoglutarate Transport, and Glutamate Export in Spinach Chloroplasts in the Presence of Dicarboxylates in the Light**—K. C. Woo*, F. A. Boyle, I. U. Flugge, and Hans W. Heldt

626 **Elicitation of Necrosis in *Vigna unguiculata* Walp, by Homogeneous *Aspergillus niger* Endo-Polygalacturonase and by α-D-Galacturonate Oligomers**—Felice Cervone*, Giulia DeLorenzo, Luisa Degrà, and Giovanni Salvi

631 **Purification and Characterization of a Polygalacturonase-Inhibiting Protein from *Phaseolus vulgaris* L.**—Felice Cervone*, Giulia De Lorenzo, Luisa Degrà, Giovanni Salvi, and Mario Bergami

638 **Phosphorylation of Photosystem II Components, CP43 Apoprotein, D1, D2, and 10 to 11 Kilodalton Protein in Chloroplast Thylakoids of Higher Plants**—Masahiko Ikeuchi*, F. Gerald Plumley, Yorinao Inoue, and Gregory W. Schmidt

643 **The Effect of Light and Phytochrome on 1-Aminocyclopropane-1-Carboxylic Acid Metabolism in Etiolated Wheat Seedling Leaves**—Xin-Zhi Jiao, Wing-Kin Yip, and Shang Fa Yang*

648 **Polysomes from Winter Rye Seedlings Grown at Low Temperature. I. Size Class Distribution, Composition, and Stability**—André Laroche and William G. Hopkins*

655 **Modulation of Water Stress Effects on Photosynthesis by Altered Leaf K^+**—Paul A. Pier and Gerald A. Berkowitz*

662 **Sink Removal and Leaf Senescence in Soybean. Cultivar Effects**—Steven J. Crafts-Brandner* and Dennis B. Egli

667 **Photosynthetic Gas Exchange Characteristics of Wheat Flag Leaf Blades and Sheaths during Grain Filling. The Case of a Spring Crop Grown under Mediterranean Climate Conditions**—José L. Araus* and Luis Tapia

674 **Membrane Potential and Proton Cotransport of Alanine and Phosphate as Affected by Permeant Weak Acids in *Lemna gibba***—Barbara Basso* and Cornelia I. Ullrich-Eberius

679 **Molecular Species Specificity of Phospholipid Breakdown in Microsomal Membranes of Senescing Carnation Flowers**—J. H. Brown, D. V. Lynch, and John E. Thompson*

684 **Differential Effects of a Substituted Pyridazinone, BASF 13-338, on Pathways of Monogalactosyldiacylglycerol Synthesis in Arbidopsis**—Helen A. Norman* and Judith B. St. John

689 **Comparison of Fluence-Response Relationships of Phototropism in Light- and Dark-Grown Buckwheat**—Richard J. Ellis

693 **Latency of Plasma Membrane H^+-ATPase in Vesicles Isolated by Aqueous Phase Partitioning. Increased substrate Accessibility or Enzyme Activation**—

Richard P. Sandstrom*, Albertus H. deBoer, Terri L. Lomax, and Robert E. Cleland

699 **Alteration of Gene Expression during the Induction of Freezing Tolerance in *Brassica napus* Suspension Cultures**—Anne M. Johnson-Flanagan and Jas Singh*

706 **Enzymology of Fructan Synthesis in Grasses. Properties of Sucrose-Sucrose-Fructosyltransferase in Barley Leaves (*Hordeum vulgare* L. cv Gerbel)**—Walter Wagner and Andres Wiemken*

711 **Facilitated Transport of Glucose in Isolated Phloem Segments of Celery**—Jaleh Daie* and Edward J. Wilusz

716 **^{31}P NMR Study of Elicitor Treated *Phaseolus vulgaris* Cell Suspension Cultures**—Israel Ojalvo, J. Stefan Rokem, Gil Navon, and Israel Goldberg*

720 **Genotype-Dependent Leaf Senescence in Maize. Inheritance and Effects of Pollination-Prevention**—Davide Ceppi, Mario Sala, Eugenio Gentinetta, Alberto Verderio, and Mario Motto*

726 **Abscisic Acid Biosynthesis in Leaves and Roots of *Xanthium strumarium***—Robert A. Creelman, Douglas A. Gage, John T. Stults, and Jan A. D. Zeevaart*

733 **An Extracellular Protein from *Phytophthora parasitica* var *nicotianae* Is Associated with Stress Metabolite Accumulation in Tobacco Callus**—Edward E. Farmer* and John P. Helgeson

741 **Subcellular Localization of Glycosidases and Glycosyltransferases Involved in the Processing of N-Linked Oligosaccharides**—Arnd Sturm, Kenneth D. Johnson, Taduesz Szumilo, Alan D. Elbein, and Maarten J. Chrispeels*

746 **Characterization of Iron Uptake from Ferrioxamine B by *Chlorella vulgaris***—F. C. Thomas Allnutt* and Walter D. Bonner, Jr.

751 **Evaluation of Reductive Release as a Mechanism for Iron Uptake from Ferrioxamine B by *Chlorella vulgaris***—F. C. Thomas Allnutt* and Walter D. Bonner, Jr.

757 **Nuclear Gene-Regulated Expression of Chloroplast Genes for Coupling Factor One in Maize**—Hirokazu Kobayashi, Lawrence Bogorad*, and C. Donald Miles

768 **Carbohydrate, Organic Acid, and Amino Acid Composition of Bacteroids and Cytosol from Soybean Nodules**—John G. Streeter

774 **Effect of Nitrate on the Organic Acid and Amino Acid Composition of Legume Nodules**—John G. Streeter

780 **Evidence that a Chloroplast Surface Protein Is Associated with a Specific Binding Site for the Precursor to the Small Subunit of Ribulose-1,5-Bisphosphate Carboxylase**—Karen L. Cornwell and Kenneth Keegstra*

786 **Effect of Altered Sink:Source Ratio on Photosynthetic Metabolism of Source Leaves**—Zvi Plaut*, Maria Luisa Mayoral, and Leonora Reinhold

792 **β-Oxidation and Glyoxylate Cycle Coupled to NADH: Cytochrome *c* and Ferricyanide Reductases in Glyoxysomes**—Robert P. Donaldson* and Tung K. Fang

796 **Orientation of Electron Transport Activities in the Membrane of Intact Glyoxysomes Isolated from Castor Bean Endosperm**—Douglas G. Luster and Robert P. Donaldson*

801 **Nickel: A Micronutrient Essential for Higher Plants**—Patrick H. Brown, Ross M. Welch*, and Earle E. Cary

804 **Characterization of the Stimulation of Ethylene Production by Galactose in Tomato (*Lycopersicon esculentum* Mill.) Fruit**—Jongkee Kim, Kenneth C. Gross*, and Theophanes Solomos

808 **Plastid Development in *Pisum sativum* Leaves during Greening. I. A Comparison of Plastid Polypeptide Composition and *in Organello* Translation Characteristics**—Karl-Josef Dietz and Lawrence Bogorad*

816 **Plastid Development in *Pisum sativum* Leaves during Greening. II. Post-Translational Uptake by Plastids as an Indicator System to Monitor Changes in Translatable mRNA for Nuclear-Encoded Plastid Polypeptides**—Karl-Josef Dietz and Lawrence Bogorad*

823 **Purification and Partial Characterization of a Hydroxyproline-Rich Glycoprotein in a Graminaceous Monocot, *Zea mays***—Marcia Kieliszewski and Derek T. A. Lamport*

828 **Solubilization and Purification of NAD(P)H Dehydrogenase of *Cucurbita* Microsomes**—Franca Guerrini, Vincenzo Valenti, and Paolo Pupillo*

835 **Monoclonal Antibodies against Fusicoccin with Binding Characteristics Similar to the Putative Fusicoccin Receptor of Higher Plants**—Martin Feyerabend and Elmar W. Weiler*

841 **The Timing and Rate of Phytic Acid Accumulation in Developing Soybean Seeds**—Victor Raboy and David B. Dickinson*

845 **Tabtoxinine-β-Lactam Transport into Cultured Corn Cells. Uptake via an Amino Acid Transport System**—Daniel R. Bush and Pat J. Langston-Unkefer*

850 **Effects of Temperature on H^+ Secretion and Uptake by Excised Flexor Cells during Dark-Induced Closure and *Samanea* Leaflets**—Ruth L. Satter*, Yujia Xu, and Anthony DePass

856 **Nitrogen Utilization in *Lemna*. I. Relations between Net Nitrate Flux, Nitrate Reduction, and *in Vitro* Activity and Stability of Nitrate Reductase**—Björn Ingemarsson

860 **Nitrogen Utilization in *Lemna*. II. Studies of Nitrate Uptake Using $^{13}NO_3^-$**—Björn Ingemarsson*, Petter Oscarson, Magnus af Ugglas, and Carl-Magnus Larsson

865 **Nitrogen Utilization in *Lemna*. III. Short-Term Effects of Ammonium on Nitrate Uptake and Nitrate Reduction**—Björn Ingemarsson*, Petter Oscarson, Magnus af Ugglas, and Carl-Magnus Larsson

Number 4. December

COMMUNICATIONS

869 **Kinetic Analysis of Resistance to Paraquat in *Conyza*. Evidence that Paraquat Transiently Inhibits Leaf Chloroplast Reactions in Resistant Plants**—Yoseph Shaaltiel and Jonathan Gressel*

872 **Generation of a Membrane Potential by Electron Transport in Plasmalemma-Enriched Vesicles of Cotton and Radish**—Miriam Hassidim, Bernard Rubinstein*, Henri R. Lerner, and Leonora Reinhold

ARTICLES

876 **Procedure to Isolate Viable Sperm Cells from Corn (*Zea mays* L.) Pollen Grains**—Isabelle Dupuis*, Patricia

Roeckel, Elisabeth Matthys-Rochon, and Christian Dumas

879 **Photoinduced Seed Germination of *Oenothera biennis* L. I. General Characteristics**—Peter A. Ensminger* and Hiroshi Ikuma

885 **Photoinduced Seed Germination of *Oenothera biennis* L. II. Analysis of the Photoinduction Period**—Peter A. Ensminger* and Hiroshi Ikuma

892 **Intracellular Carbon Partitioning in *Chlamydomonas reinhardtii***—Uwe Klein

898 **Mutations in *Chlamydomonas reinhardtii* Conferring Resistance to the Herbicide Sulfometuron Methyl**—Mary E. Hartnett, John R. Newcomb, and Robert C. Hodson*

902 **Transport and Metabolism of a Sucrose Analog (1′-Fluorosucrose) into *Zea mays* L. Endosperm without Invertase Hydrolysis**—Judy Gougler Schmalstig* and William D. Hitz

906 **Polyamine Oxidase from Water Hyacinth. Purification and Properties**—Hiroshi Yanagisawa*, Akemi Kato, Sawa Hoshiai, Akiyoshi Kamiya, and Naohiro Torii

910 **Xanthophylls and Abscisic Acid Biosynthesis in Water-Stressed Bean Leaves**—Yi Li and Daniel C. Walton*

916 **Conversion of Xanthoxin to Abscisic Acid by Cell-Free Preparations from Bean Leaves**—Ram K. Sindhu and Daniel C. Walton*

922 **Mesophyll Resistances to SO_2 Fluxes into Leaves**—Hardy Pfanz, Enrico Martinoia, Otto-Ludwig Lange, and Ulrich Heber*

928 **Flux of SO_2 into Leaf Cells and Cellular Acidification by SO_2**—Hardy Pfanz, Enrico Martinoia, Otto-Ludwig Lange, and Ulrich Heber*

934 ***In Vitro* Gibberellin A_1 Binding in *Zea mays* L.**—Brian Keith and Lawrence Rappaport*

942 **Classification and Structural Comparison of Full-Length cDNAs for Pathogenesis-Related Proteins**—Makoto Matsuoka*, Naoki Yamamoto, Yuriko Kano-Murakami, Yoshiyuki Tanaka, Yoshihiro Ozeki, Hisashi Hirano, Hiroyuki Kagawa, Masahiro Oshima, and Yuko Ohashi

947 **Comparative Studies of Phosphoenolpyruvate Carboxylase from C_3 and C_4 Plants**—Makoto Matsuoka* and Shingo Hata

952 **Form of Inorganic Carbon Involved as a Product and as an Inhibitor of C_4 Acid Decarboxylases Operating in C_4 Photosynthesis**—Colin L. D. Jenkins, James N. Burnell, and Marshall D. Hatch*

958 **Mechanism of C_4 Photosynthesis. The Size and Composition of the Inorganic Carbon Pool in Bundle Sheath Cells**—Robert T. Furbank and Marshall D. Hatch*

965 **Studies on Octylphenoxy Surfactants. III. Sorption of Triton X-100 by Isolated Tomato Fruit Cuticles**—Warren E. Shafer and Martin J. Bukovac*

971 **Regulation of Light-Harvesting Chlorophyll Protein Biosynthesis in Greening Seedlings. A Species Comparison**—James N. Mathis and Kent O. Burkey*

978 **Photosynthetic Characteristics of the C_3-C_4 Intermediate *Parthenium hysterophorus***—Brandon D. Moore*, Vincent R. Franceschi, Shu-Hua Cheng, Jingrui Wu, and Maurice S. B. Ku

984 **Nucleotide Metabolism in Salt-Stressed *Zea mays* L. Root Tips. I. Adenine and Uridine Nucleotides**—Todd A. Peterson, Richard H. Nieman*, and Robert A. Clark

990 **Carbon Dioxide and Light Responses of Photosynthesis in Cowpea and Pigeonpea during Water Deficit and Recovery**—Francis B. Lopez, Tim L. Setter*, and Charles R. McDavid

996 **Active Glucose Transport and Proton Pumping in Tonoplast Membrane of *Zea mays* L. Coleoptiles Are Inhibited by Anti-H^+-ATPase Antibodies**—Thomas Rausch, Dennis N. Butcher, and Lincoln Taiz

1000 **Reduction State of Q and Nonradiative Energy Dissipation during Photosynthesis in Leaves of a Crassulacean Acid Metabolism Plant, *Kalanchoë daigremontiana* Hamet et Perr**—Klaus Winter* and Barbara Demmig

1008 **Inhibition of Mung Bean UDP-Glucose: (1→3)-β-Glucan Synthase by UDP-Pyridoxal. Evidence for an Active-Site Amino Group**—Steve M. Read* and Deborah P. Delmer

1016 **Superoxide Dismutase as an Anaerobic Polypeptide. A Key Factor in Recovery from Oxygen Deprivation in *Iris pseudacorus*?**—Lorna S. Monk, Kurt V. Fagerstedt, and Robert M. M. Crawford

1021 **Construction of an Obligate Photoheterotrophic Mutant of the Cyanobacterium *Synechocystis* 6803. Inactivation of the *psbA* Gene Family**—Christer Jansson, Richard J. Debus, Heinz D. Osiewacz, Michael Gurevitz, and Lee McIntosh*

1026 **Metabolization of Elemental Sulfur in Wheat Leaves Consecutive to Its Foliar Application**—Stéphanie Legris-Delaporte, Françoise Ferron, Jacques Landry, and Claude Costes*

1031 **Phytochelatin Synthesis and Glutathione Levels in Response to Heavy Metals in Tomato Cells**—Henrik V. Scheller, Bin Huang, Evelyn Hatch, and Peter B. Goldsbrough*

1036 **Different Characteristics of the Two Glutamate Synthases in the Green Leaves of *Lycopersicon esculentum***—Concepción Avila, José R. Botella, Francisco M. Cánovas, Ignacio Núñez de Castro, and Victoriano Valpuesta*

1040 **Osmotic Adjustment, Symplast Volume, and Nonstomatally Mediated Water Stress Inhibition of Photosynthesis in Wheat**—Ashima Sen Gupta and Gerald A. Berkowitz*

1048 **Plant Plasma Membrane Proteins. Immunological Characterization of a Major 75 Kilodalton Protein Group**—Howard D. Grimes* and R. William Breidenbach

1055 **Effect of Salinity on Leaf Gas Exchange in Two Populations of a C_4 Nonhalophyte**—William D. Bowman

1059 **Histochemical Technique: Densitometry of Nanogram Quantities of Proteins Separated in One-Dimensional Microslab Gels**—Mitchell C. Tarczynski* and William H. Outlaw, Jr.

1063 **Photosynthesis in *Flaveria brownii* A.M. Powell. A C_4-Like C_3-C_4 Intermediate**—Russell K. Monson*, William S. Schuster, and Maurice S. B. Ku

1068 **Ice Encasement Injury to Microsomal Membranes from Winter Wheat Crowns. I. Comparison of Membrane Properties after Lethal Ice Encasement and during a Post-Thaw Period**—P. Richard Hetherington, Bryan D. McKersie*, and Amihud Borochov

1073 **Pathways of Fatty Acid Hydroperoxide Metabolism in Spinach Leaf Chloroplasts**—Brady A. Vick* and Don C. Zimmerman

1079 **The C-S Lyases of Higher Plants. Direct Comparison of the Physical Properties of Homogeneous Alliin Lyase of Garlic (*Allium sativum*) and Onion (*Allium cepa*)**—Linda P. Nock and Mendel Mazelis*

1084 **An Antibody to the Castor Bean Glyoxysomal Lipase (62 kD) also Binds to a 62 kD Protein in Extracts from**

Many Young Oilseed Plants—Matthew J. Hills and Harry Beevers*

1089 **Development of the *alt* Mutant of *Pisum sativum* L.**—Wei Wen Guo, William M. Proebsting*, Sandra W. Potter, Larry S. Daley, and John R. Potter

1094 **Protein Synthesis during Rehydration of Rapidly Dried *Tortula ruralis*. Evidence for Oxidation Injury**—Rajinder S. Dhindsa

1099 **Subcellular Localization of Enzymes Involved in Indole Alkaloid Biosynthesis in *Catharanthus roseus***—Vincenzo De Luca* and Adrian J. Cutler

1103 ***Bacillus thuringiensis* δ-Endotoxin Expressed in Transgenic *Nicotiana tabacum* Provides Resistance to Lepidopteran Insects**—Kenneth A. Barton*, H. R. Whiteley, and Ning-Sun Yang

1110 **Isolation and Characterization of Plant Genes Coding for Acetolactate Synthase, the Target Enzyme for Two Classes of Herbicides**—Barbara J. Mazur*, Chok-Fun Chui, and Julie K. Smith

1118 **Isozymes of β-*N*-Acetylhexosaminidase from Pea Seeds (*Pisum sativum* L.)**—Suzanne M. Harley and Leonard Beevers*

1123 **Biochemistry of Oleoresinosis. Monoterpene and Diterpene Biosynthesis in Lodgepole Pine Saplings Infected with *Ceratocystis clavigera* or Treated with Carbohydrate Elicitors**—Rodney Croteau*, Sandra Gurkewitz, Mark A. Johnson, and Henry J. Fisk

1129 **Calcium Transport in Sealed Vesicles from Red Beet (*Beta vulgaris* L.) Storage Tissue. I. Characterization of a Ca^{2+}-Pumping ATPase Associated with the Endoplasmic Reticulum**—John L. Giannini, Lynne H. Gildensoph, Ingrid Reynolds-Niesman, and Donald P. Briskin*

1137 **Calcium Transport in Sealed Vesicles from Red Beet (*Beta vulgaris* L.) Storage Tissue. II. Characterization of $^{45}Ca^{2+}$ Uptake into Plasma Membrane Vesicles**—John L. Giannini, Jose Ruiz-Cristin, and Donald P. Briskin*

1143 **Carbon Isotope Ratios Demonstrate Carbon Flux from C_4 Host to C_3 Parasite**—Malcolm C. Press*, Nishith Shah, Janet M. Tuohy, and George R. Stewart

1146 **Wavelength Effect on the Action of a *N*-Phenylimide S-23142 and a Diphenylether Acifluorfen-Ethyl in Cotyledons of Cucumber (*Cucumis sativus* L.) Seedlings**—Ryo Sato*, Eiki Nagano, Hiromichi Oshio, Katsuzo Kamoshita, and Masaki Furuya

1151 **Phosphatidylinositol Specific Phospholipase C of Plant Stems. Membrane Associated Activity Concentrated in Plasma Membranes**—Helmut Pfaffmann, Elmar Hartmann, Andrew O. Brightman, and D. James Morré*

Volume Contents by Subject

METABOLISM AND ENZYMOLOGY

13 **Ion-Exchange Chromatography Separates Activities Synthesizing and Degrading Fructose 2,6-Bisphosphate from C_3 and C_4 Leaves but Not from Rat Liver**—Fraser D. Macdonald, Qun Chou, and Bob B. Buchanan*

51 **Regulation by Phospholipids and Kinetic Studies of Plant Membrane-Bound UDP-Glucose Sterol β-D-Glucosyl Transferase**—Pascaline Ullmann, Pierrette Bouvier-Navé*, and P. Benveniste

56 **Inhibition of Pear Fruit Ripening by Mannose**—Christopher B. Watkins and Chaim Frenkel*

66 **Factors Affecting the Activation State and the Level of Total Activity of Ribulose Bisphosphate Carboxylase in Tobacco Protoplasts**—Michael E. Salvucci* and Joan C. Anderson

72 **Carbonic Anhydrase and the Uptake of Inorganic Carbon by *Synechococcus* sp. (UTEX-2380)**—ChingKuang Tu, Hart Spiller, George C. Wynns, and David N. Silverman*

78 **Subcellular Localization of Amines and Activities of Their Biosynthetic Enzymes in *p*-Fluorophenylalanine Resistant and Wild-Type Tobacco Cell Cultures**—Mark A. Walker*, Brian E. Ellis, Clint C. S. Chapple, and Erwin B. Dumbroff

87 **Partial Purification of Gibberellin Oxidases from Spinach Leaves**—Sarah J. Gilmour, Anthony B. Bleecker, and Jan A. D. Zeevaart*

96 **Nitric Oxide Emissions from Soybean Leaves during *in Vivo* Nitrate Reductase Assays**—Lowell A. Klepper

124 **Light and Acetate Regulate a Mitochondrial Malate Dehydrogenase**—Friedhelm Struck, Sabine Grölz-Krug, Bruce Boschek, and Klaus Zetsche*

131 **Modulation of Pea Membrane β-Glucan Synthase Activity by Calcium, Polycation, Endogenous Protease, and Protease Inhibitor**—Vincent Girard and Gordon Maclachlan*

145 **Purification and Characterization of Dihydrodipicolinate Synthase from Wheat Suspension Cultures**—Rosarin Kumpaisal, Takashi Hashimoto, and Yasuyuki Yamada*

152 **Rubisco Activase Mediates ATP-Dependent Activation of Ribulose Bisphosphate Carboxylase**—V. J. Streusand and Archie R. Portis, Jr.*

155 **Uptake and Fate of Ethephon ([2-Chloroethyl]phosphonic Acid) in Dormant Weed Seeds**—J. Stephen Goudey, Hargurdeep S. Saini, and Mary S. Spencer*

158 **Functional Size of Photosynthetic Electron Transport Chain Determined by Radiation Inactivation**—Run Sun Pan, Lee Feng Chien, May Yun Wang, Mai Yu Tsai, Rong Long Pan*, and Ban Dar Hsu

182 **Subunit Structure of Spinach Leaf ADPglucose Pyrophosphorylase**—Matthew K. Morell, Mark Bloom, Vicki Knowles, and Jack Preiss*

277 **Banana Ripening: Implications of Changes in Internal Ethylene and CO_2 Concentrations, Pulp Fructose 2,6-Bisphosphate Concentration, and Activity of Some Glycolytic Enzymes**—Randolph M. Beaudry, Nachman Paz, Clanton C. Black, and Stanley J. Kays*

294 **Hill Reaction, Hydrogen Peroxide Scavenging, and Ascorbate Peroxidase Activity of Mesophyll and Bundle Sheath Chloroplasts of NADP-Malic Enzyme Type C_4 Species**—Yoshiyuki Nakano and Gerald E. Edwards*

360 **Localization of Carbohydrate Metabolizing Enzymes in Guard Cells of *Commelina communis***—Nina L. Robinson and Jack Preiss*

365 **Glyphosate Effects on Carbon Assimilation and Gas Exchange in Sugar Beet Leaves**—Donald R. Geiger*, Michelle A. Tucci, and Jerome C. Servaites

370 **Glyphosate Effects on Carbon Assimilation, Ribulose Bisphosphate Carboxylase Activity, and Metabolite Levels in Sugar Beet Leaves**—Jerome C. Servaites, Michelle A. Tucci, and Donald R. Geiger*

375 **Characterization of Nitrate Reductases from Corn Leaves (*Zea mays* cv W64AxW182E) and *Chlorella vulgaris*. Sensitivity to a Proteinase Extracted from Corn Roots**—M. Poulle, Ann Oaks*, P. Bzonek, V. J. Goodfellow, and L. P. Solomonson

407 **Contributions of Sucrose Synthase and Invertase to the Metabolism of Sucrose in Developing Leaves. Estimation by Alternate Substrate Utilization**—J. Gougler Schmalstig and William D. Hitz*

440 **Proglobulin Processing Enzyme in Vacuoles Isolated from Developing Pumpkin Cotyledons**—Ikuko Hara-Nishimura* and Mikio Nishimura

446 **Reduction of Purothionin by the Wheat Seed Thioredoxin System**—Thomas C. Johnson, Keishiro Wada, Bob B. Buchanan*, and Arne Holmgren

457 **Purification and Characterization of Microsomal Cytochrome b_5 and NADH Cytochrome b_5 Reductase from *Pisum sativum***—David R. Jollie, Stephen G. Sligar, and Mary Schuler*

463 **Characterization of Acetate and Pyruvate Metabolism in Suspension Cultures of *Zea mays* by ^{13}C NMR Spectroscopy**—Dennis J. Ashworth*, Rino Y. Lee, and Douglas O. Adams

469 **Induction of Sesquiterpenoid Biosynthesis in Tobacco Cell Suspension Cultures by Fungal Elicitor**—Joseph Chappell* and Ross Nable

474 **Activities of Isolated Mitochondria and Mitochondrial Enzymes from Aerobically and Anaerobically Germinated Barnyard Grass (*Echinochloa*) Seedlings**—Robert A. Kennedy*, Theodore C. Fox, and James N. Siedow

497 **Temperature Effects on Phosphoenolpyruvate Carboxylase from a CAM and a C_4 Plant. A Comparative Study**—Min-Xian Wu and Randolph T. Wedding*

516 **CHAPS Solubilization and Functional Reconstitution of β-Glucan Synthase from Red Beet Root (*Beta vulgaris* L.) Storage Tissue**—Margaret E. Sloan, Panayotis Rodis, and Bruce P. Wasserman*

523 **Involvement of Macromolecule Biosynthesis in Auxin and Fusicoccin Enhancement of β-Glucan Synthase Activity in Pea**—Peter M. Ray

570 **Increased Levels of Peroxisomal Active Oxygen-Related Enzymes in Copper-Tolerant Pea Plants**—José M. Palma, Manuel Gómez, Juan Yáñez, and Luis A. Del Río*

585 **Sodium Requirement for Photosynthesis and Its Relationship with Dinitrogen Fixation and the External CO_2 Concentration in Cyanobacteria**—Eva Sanchez Maeso, Francisca Fernandez Piñas, Mercedes Garcia Gonzalez, and Eduardo Fernandez Valiente*

598 **Changing Activity of Glucose-6-Phosphate Dehydrogenase from Pea Chloroplasts during Photosynthetic**

* Author to whom correspondence should be addressed.

Continued on next page

Induction—Xiao-Hua Yuan and Louise E. Anderson*

611 **Chloroplast as a Locale of L-*myo*-Inositol-1-Phosphate Synthase**—Jukta Adhikari, Asima Lahiri Majumder, Tirtha Jyoti Bhaduri, Sarmila DasGupta, and Arun Lahiri Majumder*

621 **^{15}N-Ammonia Assimilation, 2-Oxoglutarate Transport, and Glutamate Export in Spinach Chloroplasts in the Presence of Dicarboxylates in the Light**—K. C. Woo*, F. A. Boyle, I. U. Flugge, and Hans W. Heldt

643 **The Effect of Light and Phytochrome on 1-Aminocyclopropane-1-Carboxylic Acid Metabolism in Etiolated Wheat Seedling Leaves**—Xin-Zhi Jiao, Wing-Kin Yip, and Shang Fa Yang*

684 **Differential Effects of a Substituted Pyridazinone, BASF 13-338, on Pathways of Monogalactosyldiacylglycerol Synthesis in Arbidopsis**—Helen A. Norman* and Judith B. St. John

706 **Enzymology of Fructan Synthesis in Grasses. Properties of Sucrose-Sucrose-Fructosyltransferase in Barley Leaves (*Hordeum vulgare* L. cv Gerbel)**—Walter Wagner and Andres Wiemken*

720 **Genotype-Dependent Leaf Senescence in Maize. Inheritance and Effects of Pollination-Prevention**—Davide Ceppi, Mario Sala, Eugenio Gentinetta, Alberto Verderio, and Mario Motto*

726 **Abscisic Acid Biosynthesis in Leaves and Roots of *Xanthium strumarium***—Robert A. Creelman, Douglas A. Gage, John T. Stults, and Jan A. D. Zeevaart*

746 **Characterization of Iron Uptake from Ferrioxamine B by *Chlorella vulgaris***—F. C. Thomas Allnutt* and Walter D. Bonner, Jr.

751 **Evaluation of Reductive Release as a Mechanism for Iron Uptake from Ferrioxamine B by *Chlorella vulgaris***—F. C. Thomas Allnutt* and Walter D. Bonner, Jr.

786 **Effect of Altered Sink:Source Ratio on Photosynthetic Metabolism of Source Leaves**—Zvi Plaut*, Maria Luisa Mayoral, and Leonora Reinhold

792 **β-Oxidation and Glyoxylate Cycle Coupled to NADH: Cytochrome *c* and Ferricyanide Reductases in Glyoxysomes**—Robert P. Donaldson* and Tung K. Fang

801 **Nickel: A Micronutrient Essential for Higher Plants**—Patrick H. Brown, Ross M. Welch*, and Earle E. Cary

828 **Solubilization and Purification of NAD(P)H Dehydrogenase of *Cucurbita* Microsomes**—Franca Guerrini, Vincenzo Valenti, and Paolo Pupillo*

892 **Intracellular Carbon Partitioning in *Chlamydomonas reinhardtii***—Uwe Klein

898 **Mutations in *Chlamydomonas reinhardtii* Conferring Resistance to the Herbicide Sulfometuron Methyl**—Mary E. Hartnett, John R. Newcomb, and Robert C. Hodson*

902 **Transport and Metabolism of a Sucrose Analog (1′-Fluorosucrose) into *Zea mays* L. Endosperm without Invertase Hydrolysis**—Judy Gougler Schmalstig* and William D. Hitz

906 **Polyamine Oxidase from Water Hyacinth. Purification and Properties**—Hiroshi Yanagisawa*, Akemi Kato, Sawa Hoshiai, Akiyoshi Kamiya, and Naohiro Torii

916 **Conversion of Xanthoxin to Abscisic Acid by Cell-Free Preparations from Bean Leaves**—Ram K. Sindhu and Daniel C. Walton*

952 **Form of Inorganic Carbon Involved as a Product and as an Inhibitor of C_4 Acid Decarboxylases Operating in C_4 Photosynthesis**—Colin L. D. Jenkins, James N. Burnell, and Marshall D. Hatch*

958 **Mechanism of C_4 Photosynthesis. The Size and Composition of the Inorganic Carbon Pool in Bundle Sheath Cells**—Robert T. Furbank and Marshall D. Hatch*

978 **Photosynthetic Characteristics of the C_3-C_4 Intermediate *Parthenium hysterophorus***—Brandon D. Moore*, Vincent R. Franceschi, Shu-Hua Cheng, Jingrui Wu, and Maurice S. B. Ku

1000 **Reduction State of Q and Nonradiative Energy Dissipation during Photosynthesis in Leaves of a Crassulacean Acid Metabolism Plant, *Kalanchoë daigremontiana* Hamet et Perr**—Klaus Winter* and Barbara Demmig

1008 **Inhibition of Mung Bean UDP-Glucose: (1→3)-β-Glucan Synthase by UDP-Pyridoxal. Evidence for an Active-Site Amino Group**—Steve M. Read* and Deborah P. Delmer

1026 **Metabolization of Elemental Sulfur in Wheat Leaves Consecutive to Its Foliar Application**—Stéphanie Legris-Delaporte, Françoise Ferron, Jacques Landry, and Claude Costes*

1036 **Different Characteristics of the Two Glutamate Synthases in the Green Leaves of *Lycopersicon esculentum***—Concepción Avila, José R. Botella, Francisco M. Cánovas, Ignacio Núñez de Castro, and Victoriano Valpuesta*

1059 **Histochemical Technique: Densitometry of Nanogram Quantities of Proteins Separated in One-Dimensional Microslab Gels**—Mitchell C. Tarczynski* and William H. Outlaw, Jr.

1073 **Pathways of Fatty Acid Hydroperoxide Metabolism in Spinach Leaf Chloroplasts**—Brady A. Vick* and Don C. Zimmerman

1079 **The C-S Lyases of Higher Plants. Direct Comparison of the Physical Properties of Homogeneous Alliin Lyase of Garlic (*Allium sativum*) and Onion (*Allium cepa*)**—Linda P. Nock and Mendel Mazelis*

1084 **An Antibody to the Castor Bean Glyoxysomal Lipase (62 kD) also Binds to a 62 kD Protein in Extracts from Many Young Oilseed Plants**—Matthew J. Hills and Harry Beevers*

1099 **Subcellular Localization of Enzymes Involved in Indole Alkaloid Biosynthesis in *Catharanthus roseus***—Vincenzo De Luca* and Adrian J. Cutler

1118 **Isozymes of β-*N*-Acetylhexosaminidase from Pea Seeds (*Pisum sativum* L.)**—Suzanne M. Harley and Leonard Beevers*

MOLECULAR BIOLOGY AND GENE REGULATION

26 **Contiguous Organization of Nitrogenase Genes in a Heterocystous Cyanobacterium**—Barry Saville, Neil Straus, and John R. Coleman*

167 **Coordinate, Organ-Specific and Developmental Regulation of Ribulose 1,5-Bisphosphate Carboxylase Gene Expression in *Amaranthus hypochondriacus***—Basil J. Nikolau and Daniel F. Klessig*

243 ***Photocontrol of* Sorghum Leaf Phosphoenolpyruvate Carboxylase. Characterization of Messenger RNA and of Photoreceptor**—Martine Thomas*, Claude Crétin, Eliane Keryer, Jean Vidal, and Pierre Gadal

299 **Production and Preliminary Characterization of Monoclonal Antibodies against Cationic Peanut Peroxidase**—Chunfang Hu*, Daniela Carboner, and Robert van Huystee

304 ***In Organello* Transcription in Maize Mitochondria and *Its Sensitivity to Inhibitors of RNA Synthesis***—

Patrick M. Finnegan and Gregory G. Brown*

327 **Construction and Homologous Expression of a Maize *Adh1* Based *Nco*I Cassette Vector**—Lisa Lee, Carmen Fenoll, and Jeffrey L. Bennetzen*

502 **Polygalacturonase Gene Expression in Rutgers, *rin*, *nor*, and *Nr* Tomato Fruits**—Dean DellaPenna, David S. Kates, and Alan B. Bennett*

757 **Nuclear Gene-Regulated Expression of Chloroplast Genes for Coupling Factor One in Maize**—Hirokazu Kobayashi, Lawrence Bogorad*, and C. Donald Miles

808 **Plastid Development in *Pisum sativum* Leaves during Greening. I. A Comparison of Plastid Polypeptide Composition and *in Organello* Translation Characteristics**—Karl-Josef Dietz and Lawrence Bogorad*

816 **Plastid Development in *Pisum sativum* Leaves during Greening. II. Post-Translational Uptake by Plastids as an Indicator System to Monitor Changes in Translatable mRNA for Nuclear-Encoded Plastid Polypeptides**—Karl-Josef Dietz and Lawrence Bogorad*

942 **Classification and Structural Comparison of Full-Length cDNAs for Pathogenesis-Related Proteins**—Makoto Matsuoka*, Naoki Yamamoto, Yuriko Kano-Murakami, Yoshiyuki Tanaka, Yoshihiro Ozeki, Hisashi Hirano, Hiroyuki Kagawa, Masahiro Oshima, and Yuko Ohashi

947 **Comparative Studies of Phosphoenolpyruvate Carboxylase from C_3 and C_4 Plants**—Makoto Matsuoka* and Shingo Hata

971 **Regulation of Light-Harvesting Chlorophyll Protein Biosynthesis in Greening Seedlings. A Species Comparison**—James N. Mathis and Kent O. Burkey*

1021 **Construction of an Obligate Photoheterotrophic Mutant of the Cyanobacterium *Synechocystis* 6803. Inactivation of the *psbA* Gene Family**—Christer Jansson, Richard J. Debus, Heinz D. Osiewacz, Michael Gurevitz, and Lee McIntosh*

1103 ***Bacillus thuringiensis* δ-Endotoxin Expressed in Transgenic *Nicotiana tabacum* Provides Resistance to Lepidopteran Insects**—Kenneth A. Barton*, H. R. Whiteley, and Ning-Sun Yang

1110 **Isolation and Characterization of Plant Genes Coding for Acetolactate Synthase, the Target Enzyme for Two Classes of Herbicides**—Barbara J. Mazur*, Chok-Fun Chui, and Julie K. Smith

ENVIRONMENTAL AND STRESS PHYSIOLOGY

1 **The Use of Cytotoxic Plant Lectins in Cancer Therapy**—J. Michael Lord

4 **Synthesis of Only Two Heat Shock Proteins Is Required for Thermoadaptation in Cultured Cowpea Cells**—Kathleen Heuss-La Rosa, Randall R. Mayer, and Joe H. Cherry*

8 **Quantification of Abscisic Acid in a Single Maize Root**—Philippe Reymond, Martial Saugy, and Paul-Emil Pilet*

62 **Compartmental Efflux Analysis and Removal of Extracellular Cadmium from Roots**—Wilfried E. Rauser

100 **Plant Morphological and Biochemical Responses to Field Water Deficits. III. Effect of Foliage Temperature on the Potential Activity of Glutathione Reductase**—John J. Burke* and Jerry L. Hatfield

109 **Effect of Photosynthetic Photon Flux Density on Carboxylation Efficiency**—James A. Weber*, John D. Tenhunen, David M. Gates, and Otto L. Lange

115 ***Glycine-Glomus-Rhizobium* Symbiosis. V. Effects of *Mycorrhiza* on Nodule Activity and Transpiration in Soybeans under Drought Stress**—Gabor J. Bethlenfalvay*, Milford S. Brown, Keiko L. Mihara, and Alan E. Stafford

120 ***Glycine-Glomus-Rhizobium* Symbiosis. VI. Photosynthesis in Nodulated, Mycorrhizal, or N- and P-Fertilized Soybean Plants**—Milford S. Brown and Gabor J. Bethlenfalvay*

164 **Errors in the Measurement of Root Pressure and Exudation Volume Flow Rate Caused by Damage during the Transfer of Unsupported Roots between Solutions**—David M. Miller

174 **Abscisic Acid Stimulated Osmotic Adjustment and Its Involvement in Adaptation of Tobacco Cells to NaCl**—P. Christopher LaRosa, Paul M. Hasegawa, David Rhodes, Jean M. Clithero, Abd-Elrahem A. Watad, and Ray A. Bressan*

199 **Knudsen-Transitional Flow and Gas Pressurization in Leaves of *Nelumbo***—John W. H. Dacey

217 **Pressure-Driven Extrusion of Intracellular Substances from Bean and Pea Cotyledons during Imbibition**—Stephen C. Spaeth

224 **Water Binding in Legume Seeds**—Christina W. Vertucci* and A. Carl Leopold

232 **The Relationship between Water Binding and Desiccation Tolerance in Tissues**—Christina W. Vertucci* and A. Carl Leopold

310 **Involvement of Superoxide Radical in Extracellular Ferric Reduction by Iron-Deficient Bean Roots**—Ismail Cakmak, Dirk A. M. van de Wetering, Horst Marschner, and H. Frits Bienfait*

315 **Citrate, Malate, and Succinate Concentration in Exudates from P-Sufficient and P-Stressed *Medicago sativa* L. Seedlings**—Doug S. Lipton, Robert W. Blanchar, and Dale G. Blevins*

318 **Promotion of Stomatal Opening by Indoleacetic Acid and Ethrel in Epidermal Strips of *Vicia faba* L.**—Linda K. Levitt, Diana B. Stein*, and Bernard Rubinstein

331 **Quantitative Estimates of Phosphorus Concentrations within *Lupinus luteus* Leaflets by Means of Electron Probe X-ray Microanalysis**—Michael T. Treeby*, Reinhard F. M. Van Steveninck, and Hilde M. De Vries

355 **The Nitrogen Use Efficiency of C_3 and C_4 Plants. III. Leaf Nitrogen Effects on the Activity of Carboxylating Enzymes in *Chenopodium album* (L.) and *Amaranthus retroflexus* (L.)**—Rowan F. Sage*, Robert W. Pearcy, and Jeffrey R. Seemann

430 **Relationship between Salt Tolerance and Resistance to Polyethylene Glycol-Induced Water Stress in Cultured Citrus Cells**—Gozal Ben-Hayyim

434 **Role of Internal Potassium in Maintaining Growth of Cultured *Citrus* Cells on Increasing NaCl and $CaCl_2$ Concentrations**—Gozal Ben-Hayyim*, Uzi Kafkafi, and Ruth Ganmore-Neumann

481 **Physiological Changes in *Portulacaria afra* (L.) Jacq. during a Summer Drought and Rewatering**—Lonnie J. Guralnick* and Irwin P. Ting

529 **Characterization of Osmotin. A Thaumatin-Like Protein Associated with Osmotic Adaptation in Plant Cells**—Narendra K. Singh, Charles A. Bracker, Paul M. Hasegawa, Avtar K. Handa, Scott Buckel, Mark A. Hermodson, Ed Pfankoch, Fred E. Regnier, and Ray A. Bressan*

575 **Establishment of Thermotolerance in Maize by Exposure to Stresses Other than a Heat Shock Does Not Require Heat Shock Protein Synthesis**—Peta C. Bonham-Smith, Manju Kapoor, and J. Derek Bewley*

581 **Interaction between Green and Far-Red Light on the Low Fluence Rate Chloroplast Orientation in *Mougeotia*—**Zbigniew Lechowski* and Jan Białczyk

592 **Regulation of Photosynthetic Carbon Metabolism in Cucumber by Light Intensity and Photosynthetic Period—**N. Suzanne Robbins and David M. Pharr*

648 **Polysomes from Winter Rye Seedlings Grown at Low Temperature. I. Size Class Distribution, Composition, and Stability—**André Laroche and William G. Hopkins*

655 **Modulation of Water Stress Effects on Photosynthesis by Altered Leaf K^+—**Paul A. Pier and Gerald A. Berkowitz*

699 **Alteration of Gene Expression during the Induction of Freezing Tolerance in *Brassica napus* Suspension Cultures—**Anne M. Johnson-Flanagan and Jas Singh*

869 **Kinetic Analysis of Resistance to Paraquat in *Conyza*. Evidence that Paraquat Transiently Inhibits Leaf Chloroplast Reactions in Resistant Plants—**Yoseph Shaaltiel and Jonathan Gressel*

922 **Mesophyll Resistances to SO_2 Fluxes into Leaves—**Hardy Pfanz, Enrico Martinoia, Otto-Ludwig Lange, and Ulrich Heber*

928 **Flux of SO_2 into Leaf Cells and Cellular Acidification by SO_2—**Hardy Pfanz, Enrico Martinoia, Otto-Ludwig Lange, and Ulrich Heber*

984 **Nucleotide Metabolism in Salt-Stressed *Zea mays* L. Root Tips. I. Adenine and Uridine Nucleotides—**Todd A. Peterson, Richard H. Nieman*, and Robert A. Clark

990 **Carbon Dioxide and Light Responses of Photosynthesis in Cowpea and Pigeonpea during Water Deficit and Recovery—**Francis B. Lopez, Tim L. Setter*, and Charles R. McDavid

1016 **Superoxide Dismutase as an Anaerobic Polypeptide. A Key Factor in Recovery from Oxygen Deprivation in *Iris pseudacorus*?—**Lorna S. Monk, Kurt V. Fagerstedt, and Robert M. M. Crawford

1031 **Phytochelatin Synthesis and Glutathione Levels in Response to Heavy Metals in Tomato Cells—**Henrik V. Scheller, Bin Huang, Evelyn Hatch, and Peter B. Goldsbrough*

1040 **Osmotic Adjustment, Symplast Volume, and Nonstomatally Mediated Water Stress Inhibition of Photosynthesis in Wheat—**Ashima Sen Gupta and Gerald A. Berkowitz*

1055 **Effect of Salinity on Leaf Gas Exchange in Two Populations of a C_4 Nonhalophyte—**William D. Bowman

1063 **Photosynthesis in *Flaveria brownii* A.M. Powell. A C_4-Like C_3-C_4 Intermediate—**Russell K. Monson*, William S. Schuster, and Maurice S. B. Ku

1068 **Ice Encasement Injury to Microsomal Membranes from Winter Wheat Crowns. I. Comparison of Membrane Properties after Lethal Ice Encasement and during a Post-Thaw Period—**P. Richard Hetherington, Bryan D. McKersie*, and Amihud Borochov

1094 **Protein Synthesis during Rehydration of Rapidly Dried *Tortula ruralis*. Evidence for Oxidation Injury—**Rajinder S. Dhindsa

1143 **Carbon Isotope Ratios Demonstrate Carbon Flux from C_4 Host to C_3 Parasite—**Malcolm C. Press*, Nishith Shah, Janet M. Tuohy, and George R. Stewart

1146 **Wavelength Effect on the Action of a *N*-Phenylimide S-23142 and a Diphenylether Acifluorfen-Ethyl in Cotyledons of Cucumber (*Cucumis sativus* L.) Seedlings—**Ryo Sato*, Eiki Nagano, Hiromichi Oshio, Katsuzo Kamoshita, and Masaki Furuya

DEVELOPMENT AND GROWTH REGULATION

10 **Role of Catecholamines in Promotion of Flowering in a Short-Day Duckweed, *Lemna paucicostata* 6746—**J. P. Khurana, B. K. Tamot, N. Maheshwari, and S. C. Maheshwari*

20 **Leaf Traits Associated with Flavonol Glycoside Genes in Soybean—**B. R. Buttery* and R. I. Buzzell

22 **5′-Azido-*N*-1-Naphthylphthalamic Acid, a Photolabile Analog of *N*-1-Naphthylphthalamic Acid. Synthesis and Binding Properties in *Curcurbita pepo* L.—**Judith G. Voet*, Kathleen S. Howley, and Jed S. Shumsky

42 **Changes in the Level of Free and Ester Indol-3yl-Acetic Acid in Growing Maize Roots—**Martial Saugy and Paul-Emile Pilet*

46 **The Development of an Indirect Enzyme Linked Immunoassay for Abscisic Acid—**Gavin S. Ross*, Peter A. Elder, James A. McWha, David Pearce, and Richard P. Pharis

82 **Uptake and Accumulation of the Herbicides Chlorsulfuron and Clopyralid in Excised Pea Root Tissue—**Malcolm D. Devine*, Hank D. Bestman, and William H. Vanden Born

91 **Free Amino Acid Content and Metabolic Activities of Setting and Aborting Soybean Ovaries—**H. Ghiasi, Christian Paech*, and C. Dean Dybing

104 **Shoot Inversion Inhibition of Stem Elongation in *Pharbitis nil*. A Possible Role for Ethylene-Induced Glycoprotein and Lignin—**Tottempudi K. Prasad and Morris G. Cline*

212 **Phytochrome Regulation of the Response to Exogenous Gibberellins by Epicotyls of *Vigna sinensis*—**José L. García-Martínez, Brian Keith, Bruce A. Bonner, Allan E. Stafford, and Lawrence Rappaport*

261 **Cell Wall Proteins at Low Water Potentials—**Connie S. Bozarth, John E. Mullet, and John S. Boyer*

273 **Control of Wild Carrot Somatic Embryo Development by Antioxidants. A Probable Mode of Action of 2,4-Dichlorophenoxyacetic Acid—**Brent A. Earnshaw and Morris A. Johnson*

290 **Assessment of Spatial Distribution of Growth in the Elongation Zone of Grass Leaf Blades—**Hans Schnyder, Curtis J. Nelson*, and John H. Coutts

343 **Biochemistry of Fern Spore Germination: Globulin Storage Proteins in *Matteuccia struthiopteris* L.—**Thomas S. Templeman, Augustus E. DeMaggio*, and David A. Stetler

350 **Far-Red Light Reflection from Green Leaves and Effects on Phytochrome-Mediated Assimilate Partitioning under Field Conditions—**Michael J. Kasperbauer

379 **Phototropism in Hypocotyls of Radish. IV. Flank Growth and Lateral Distribution of *cis*- and *trans*-Raphanusanins in the First Positive Phototropic Curvature—**Koji Hasegawa*, Hisashi Noguchi, Chikako Tanoue, Seiji Sando, Mitsuo Takada, Masako Sakoda, and Tohru Hashimoto

393 **Master Regulatory Genes, Auxin Leaves, and Sexual Organogeneses in the Dioecious Plant *Mercurialis annua*—**Saïd Hamdi*, Gerard Teller, and Jean-Paul Louis

400 **Protein Synthesis Associated with Quiescence and Senescence in Auxin-Starved Pear Cells—**Jean-Marc Lelievre*, Claudine Balague, Jean-Claude Pech, and Yves Meyer

419 **Simultaneous Quantitation of Indole 3-Acetic Acid and Abscisic Acid in Small Samples of Plant Tissue by Gas Chromatography/Mass Spectrometry/Selected**

Ion Monitoring—John H. Vine*, Dominique Noiton, Julie A. Plummer, Cristina Baleriola-Lucas, and Michael G. Mullins

542 **On the Nature and Origin of the Calcium Asymmetry Arising during Gravitropic Response in Etiolated Pea Epicotyls**—Fernando Migliaccio and Arthur W. Galston*

548 **Growth Rates and Carbohydrate Fluxes within the Elongation Zone of Tall Fescue Leaf Blades**—Hans Schnyder and Curtis J. Nelson*

588 **Intracellular pH of Cotton Embryos and Seed Coats during Fruit Development Determined by ^{31}P Nuclear Magnetic Resonance Spectroscopy**—Donald L. Hendrix*, John W. Radin, and Ronald A. Nieman

605 **Identification of Endogenous Gibberellins from Oilseed Rape**—Stewart B. Rood*, David Pearce, and Richard P. Pharis

615 **Genetic Regulation of Development in *Sorghum bicolor*. IV. GA_3 Hastens Floral Differentiation but Not Floral Development under Nonfavorable Photoperiods**—Page W. Morgan* and J. Roy Quinby

662 **Sink Removal and Leaf Senescence in Soybean. Cultivar Effects**—Steven J. Crafts-Brandner* and Dennis B. Egli

667 **Photosynthetic Gas Exchange Characteristics of Wheat Flag Leaf Blades and Sheaths during Grain Filling. The Case of a Spring Crop Grown under Mediterranean Climate Conditions**—José L. Araus* and Luis Tapia

689 **Comparison of Fluence-Response Relationships of Phototropism in Light- and Dark-Grown Buckwheat**—Richard J. Ellis

804 **Characterization of the Stimulation of Ethylene Production by Galactose in Tomato (*Lycopersicon esculentum* Mill.) Fruit**—Jongkee Kim, Kenneth C. Gross*, and Theophanes Solomos

835 **Monoclonal Antibodies against Fusicoccin with Binding Characteristics Similar to the Putative Fusicoccin Receptor of Higher Plants**—Martin Feyerabend and Elmar W. Weiler*

841 **The Timing and Rate of Phytic Acid Accumulation in Developing Soybean Seeds**—Victor Raboy and David B. Dickinson*

879 **Photoinduced Seed Germination of *Oenothera biennis* L. I. General Characteristics**—Peter A. Ensminger* and Hiroshi Ikuma

885 **Photoinduced Seed Germination of *Oenothera biennis* L. II. Analysis of the Photoinduction Period**—Peter A. Ensminger* and Hiroshi Ikuma

910 **Xanthophylls and Abscisic Acid Biosynthesis in Water-Stressed Bean Leaves**—Yi Li and Daniel C. Walton*

934 ***In Vitro* Gibberellin A_1 Binding in *Zea mays* L.**—Brian Keith and Lawrence Rappaport*

1089 **Development of the *alt* Mutant of *Pisum sativum* L.**—Wei Wen Guo, William M. Proebsting*, Sandra W. Potter, Larry S. Daley, and John R. Potter

1151 **Phosphatidylinositol Specific Phospholipase C of Plant Stems. Membrane Associated Activity Concentrated in Plasma Membranes**—Helmut Pfaffmann, Elmar Hartmann, Andrew O. Brightman, and D. James Morré*

CELLULAR AND STRUCTURAL BIOLOGY

247 **Mass-Action Expressions of Ion Exchange Applied to Ca^{2+}, H^+, K^+, and Mg^{2+} Sorption on Isolated Cell Walls of Leaves from *Brassica oleracea***—Douglas Scott Bush* and John G. McColl

268 **Actin of *Chara* Giant Internodal Cells. A Single Isoform in the Subcortical Filament Bundles and a Larger, Immunologically Related Protein in the Chloroplasts**—Richard E. Williamson*, David W. McCurdy, Ursula A. Hurley, and Jean L. Perkin

322 **Immunological Conservation of Phycobilisome Rod Linker Polypeptides**—Barbara A. Zilinskas* and Dawn A. Howell

487 **Does Gibberellic Acid Induce the Transfer of Lipase from Protein Bodies to Lipid Bodies in Barley Aleurone Cells?**—Donna E. Fernandez* and L. Andrew Staehelin

554 **Acid-Induced Stomatal Opening in *Vicia faba* L. and the Role of Guard Cell Wall Elasticity**—Dennis J. Bittisnich*, Lynda O. Entwisle, and Tom F. Neales

741 **Subcellular Localization of Glycosidases and Glycosyltransferases Involved in the Processing of N-Linked Oligosaccharides**—Arnd Sturm, Kenneth D. Johnson, Taduesz Szumilo, Alan D. Elbein, and Maarten J. Chrispeels*

780 **Evidence that a Chloroplast Surface Protein Is Associated with a Specific Binding Site for the Precursor to the Small Subunit of Ribulose-1,5-Bisphosphate Carboxylase**—Karen L. Cornwell and Kenneth Keegstra*

823 **Purification and Partial Characterization of a Hydroxyproline-Rich Glycoprotein in a Graminaceous Monocot, *Zea mays***—Marcia Kieliszewski and Derek T. A. Lamport*

876 **Procedure to Isolate Viable Sperm Cells from Corn (*Zea mays* L.) Pollen Grains**—Isabelle Dupuis*, Patricia Roeckel, Elisabeth Matthys-Rochon, and Christian Dumas

MICROBE-PLANT INTERACTIONS

34 **Transient Induction of Phenylalanine Ammonia-Lyase and 4-Coumarate: CoA Ligase mRNAs in Potato Leaves Infected with Virulent or Avirulent Races of *Phytophthora infestans***—Karl-Heinrich Fritzemeier, Claude Crétin, Erich Kombrink, Frauke Rohwer, Janet Taylor, Dierk Scheel, and Klaus Hahlbrock*

137 **Carbohydrate Supply and N_2 Fixation in Soybean. The Effect of Varied Daylength and Stem Girdling**—Kerry B. Walsh*, J. Kevin Vessey, and David B. Layzell

283 **Nonphotosynthetic CO_2 Fixation by Alfalfa (*Medicago sativa* L.) Roots and Nodules**—Michael P. Anderson, Gary H. Heichel*, and Carroll P. Vance

335 **Trifolitoxin Production and Nodulation Are Necessary for the Expression of Superior Nodulation Competitiveness by *Rhizobium leguminosarum* bv. *trifolii* Strain T24 on Clover**—Eric W. Triplett* and Terese M. Barta

452 **Appearance of Purine-Catabolizing Enzymes in Fix^+ and Fix^- Root Nodules on Soybean and Effect of Oxygen on the Expression of the Enzymes in Callus Tissue**—Knud Larsen and Bjarne U. Jochimsen*

508 **Monoclonal Antibodies to Glycoprotein Antigens of a Fungal Plant Pathogen, *Phytophthora megasperma* f. sp. *glycinea***—Keith L. Wycoff, Jody Jellison, and Arthur R. Ayers*

537 **The Effect of *Pseudomonas putida* Colonization on Root Surface Peroxidase**—Frederick Albert and Anne J. Anderson*

566 **Leaves of the Orchid Twayblade (*Listera ovata*) Contain a Mannose-Specific Lectin**—Els J. M. Van Damme,

Anthony K. Allen, and Willy J. Peumans*

601 **Breakdown of Phosphatidylinositol during the Elicitation of Phytoalexin Production in Cultured Carrot Cells**—Fumiya Kurosaki*, Yutaka Tsurusawa, and Arasuke Nishi

626 **Elicitation of Necrosis in *Vigna unguiculata* Walp, by Homogeneous *Aspergillus niger* Endo-Polygalacturonase and by α-D-Galacturonate Oligomers**—Felice Cervone*, Giulia DeLorenzo, Luisa Degrà, and Giovanni Salvi

631 **Purification and Characterization of a Polygalacturonase-Inhibiting Protein from *Phaseolus vulgaris* L.**—Felice Cervone*, Giulia De Lorenzo, Luisa Degrà, Giovanni Salvi, and Mario Bergami

716 **^{31}P NMR Study of Elicitor Treated *Phaseolus vulgaris* Cell Suspension Cultures**—Israel Ojalvo, J. Stefan Rokem, Gil Navon, and Israel Goldberg*

733 **An Extracellular Protein from *Phytophthora parasitica* var *nicotianae* Is Associated with Stress Metabolite Accumulation in Tobacco Callus**—Edward E. Farmer* and John P. Helgeson

768 **Carbohydrate, Organic Acid, and Amino Acid Composition of Bacteroids and Cytosol from Soybean Nodules**—John G. Streeter

774 **Effect of Nitrate on the Organic Acid and Amino Acid Composition of Legume Nodules**—John G. Streeter

1123 **Biochemistry of Oleoresinosis. Monoterpene and Diterpene Biosynthesis in Lodgepole Pine Saplings Infected with *Ceratocystis clavigera* or Treated with Carbohydrate Elicitors**—Rodney Croteau*, Sandra Gurkewitz, Mark A. Johnson, and Henry J. Fisk

MEMBRANES AND BIOENERGETICS

17 **Changes in the Cationic Regulation of Structure and Function in Thylakoids Isolated from Wheat Seedlings Treated with BASF 13.338**—Ramasamy Mannar Mannan* and Salil Bose

30 **Inhibition of Na^+/H^+ Antiport Activity in Sugar Beet Tonoplast by Analogs of Amiloride**—Eduardo Blumwald*, Edward J. Cragoe, Jr., and Ronald J. Poole

188 **Effects of Diclofop and Diclofop-Methyl on the Membrane Potentials of Wheat and Oat Coleoptiles**—John P. Wright and Richard H. Shimabukuro

194 **Dynamics of Photosystem II and Its Light Harvesting System in Response to Light Changes in the Halotolerant Alga *Dunaliella salina***—Uri Pick, Kleoniki Gounaris, and James Barber

204 **Membrane Deterioration in Senescing Carnation Flowers. Coordinated Effects of Phospholipid Degradation and the Action of Membranous Lipoxygenase**—Maribeth Fobel, Daniel V. Lynch, and John E. Thompson*

239 **Light Induced Polarity of Redox Reactions in Leaves of *Elodea canadensis* Michx**—J. Theo M. Elzenga* and Hidde B. A. Prins

383 **Osmotically Induced Proton Extrusion from Carrot Cells in Suspension Culture**—Moshe Reuveni*, Roberta Colombo, Henri R. Lerner, Alain Pradet, and Alexandra Poljakoff-Mayber

389 **Polyphosphoinositides Are Present in Plasma Membranes Isolated from Fusogenic Carrot Cells**—Jeffery J. Wheeler and Wendy F. Boss*

413 **Properties of Single K^+ and Cl^- Channels in *Asclepias tuberosa* Protoplasts**—Charles L. Schauf* and Kathryn J. Wilson

423 **Influence of Mannose on the Apoplasmic Retrieval Systems of Source Leaves**—William J. Lucas* and Clyde Wilson

558 **Assimilate Unloading from Maize (*Zea mays* L.) Pedicel Tissues. II. Effects of Chemical Agents on Sugar, Amino Acid, and ^{14}C-Assimilate Unloading**—Gregory A. Porter*, Daniel P. Knievel, and Jack C. Shannon

608 **Microelectrode Measurements on Red Beet Vacuole. Biological Effect of Na^+ or NO_3^- Ions, Diffusing from the Microelectrode**—Jean-Paul Lassalles*, Joël Alexandre, and Michel Thellier

638 **Phosphorylation of Photosystem II Components, CP43 Apoprotein, D1, D2, and 10 to 11 Kilodalton Protein in Chloroplast Thylakoids of Higher Plants**—Masahiko Ikeuchi*, F. Gerald Plumley, Yorinao Inoue, and Gregory W. Schmidt

674 **Membrane Potential and Proton Cotransport of Alanine and Phosphate as Affected by Permeant Weak Acids in *Lemna gibba***—Barbara Basso* and Cornelia I. Ullrich-Eberius

679 **Molecular Species Specificity of Phospholipid Breakdown in Microsomal Membranes of Senescing Carnation Flowers**—J. H. Brown, D. V. Lynch, and John E. Thompson*

693 **Latency of Plasma Membrane H^+-ATPase in Vesicles Isolated by Aqueous Phase Partitioning. Increased substrate Accessibility or Enzyme Activation**—Richard P. Sandstrom*, Albertus H. deBoer, Terri L. Lomax, and Robert E. Cleland

711 **Facilitated Transport of Glucose in Isolated Phloem Segments of Celery**—Jaleh Daie* and Edward J. Wilusz

796 **Orientation of Electron Transport Activities in the Membrane of Intact Glyoxysomes Isolated from Castor Bean Endosperm**—Douglas G. Luster and Robert P. Donaldson*

845 **Tabtoxinine-β-Lactam Transport into Cultured Corn Cells. Uptake via an Amino Acid Transport System**—Daniel R. Bush and Pat J. Langston-Unkefer*

850 **Effects of Temperature on H^+ Secretion and Uptake by Excised Flexor Cells during Dark-Induced Closure and *Samanea* Leaflets**—Ruth L. Satter*, Yujia Xu, and Anthony DePass

856 **Nitrogen Utilization in *Lemna*. I. Relations between Net Nitrate Flux, Nitrate Reduction, and *in Vitro* Activity and Stability of Nitrate Reductase**—Björn Ingemarsson

860 **Nitrogen Utilization in *Lemna*. II. Studies of Nitrate Uptake Using $^{13}NO_3^-$**—Björn Ingemarsson*, Petter Oscarson, Magnus af Ugglas, and Carl-Magnus Larsson

865 **Nitrogen Utilization in *Lemna*. III. Short-Term Effects of Ammonium on Nitrate Uptake and Nitrate Reduction**—Björn Ingemarsson*, Petter Oscarson, Magnus af Ugglas, and Carl-Magnus Larsson

872 **Generation of a Membrane Potential by Electron Transport in Plasmalemma-Enriched Vesicles of Cotton and Radish**—Miriam Hassidim, Bernard Rubinstein*, Henri R. Lerner, and Leonora Reinhold

965 **Studies on Octylphenoxy Surfactants. III. Sorption of Triton X-100 by Isolated Tomato Fruit Cuticles**—Warren E. Shafer and Martin J. Bukovac*

996 **Active Glucose Transport and Proton Pumping in Tonoplast Membrane of *Zea mays* L. Coleoptiles Are Inhibited by Anti-H^+-ATPase Antibodies**—Thomas Rausch, Dennis N. Butcher, and Lincoln Taiz

1048 **Plant Plasma Membrane Proteins. Immunological Characterization of a Major 75 Kilodalton Protein**

Group—Howard D. Grimes* and R. William Breidenbach

1129 **Calcium Transport in Sealed Vesicles from Red Beet (*Beta vulgaris* L.) Storage Tissue. I. Characterization of a Ca^{2+}-Pumping ATPase Associated with the Endoplasmic Reticulum**—John L. Giannini, Lynne H. Gildensoph, Ingrid Reynolds-Niesman, and Donald P. Briskin*

1137 **Calcium Transport in Sealed Vesicles from Red Beet (*Beta vulgaris* L.) Storage Tissue. II. Characterization of $^{45}Ca^{2+}$ Uptake into Plasma Membrane Vesicles**—John L. Giannini, Jose Ruiz-Cristin, and Donald P. Briskin*